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TEAMWORK

Cooperation the Master Key
to Modern Production

Being the First Unit
of a Course in Modern
Production Methods

BUSINESS TRAINING CORPORATION
NEW YORK CITY

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Course in
Modern Production Methods

JOHN CALDER, Director

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The text of the Course is issued in six units as follows:

I. Teamwork
II. Handling Men
III. Organization
IV. Machinery and Materials
V. Production Records
VI. Management

BUSINESS TRAINING CORPORATION
NEW YORK CITY

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Three Elements in Production

MODERN production is a matter of Men, Machinery, and Materials—of men in cooperation with one another using machinery to change raw materials into a finished product.

The industrial plant, though it include costly equipment and giant machines and though it be housed in buildings covering acres, is after all simply a tool of production.

The raw material out of which products are made is merely lifeless matter.

Both plant and material are useless without the organizing touch and the cooperative labor of that third element, men—the men who supervise the business, and the great rank and file of those who carry out the plans of the management.

The underlying principle of it all is COOPERATION—the teamwork of managers with workmen, of workmen with one another, and of all with the tools which aid production and the materials which enter into production.

The study of Modern Production Methods is the study of this teamwork as it is organized, manned, equipped, and carried on under the tremendous pressure of present-day conditions.

I

Your Share in Production

AMONG the employees taken on by a New England wire mill in the year 1878 was a sixteen-year-old day laborer who has made himself a leader in American industry.

From Day Laborer to Industrial Executive

There was nothing at the time to stamp him as out of the ordinary. In intelligence, in physical strength, in the ability to do twelve hours of hard labor, he was apparently no better than the average of his fellow workmen; and he was less experienced. Yet, within a few months this boy had outstripped many of his elders; and by the time he was twenty-one he was holding down a job as expert mechanic. Two years later he was foreman over three hundred workmen. At thirty he was general manager of the Pittsburgh Wire Company. Today he is president of the United States Steel Corporation and one of the master steel men of the world.

If you seek the reason for James A. Farrell's rapid rise and remarkable success, you will not find it in luck or "pull." Whatever difference there was between the young workman and his associates was a difference that he created himself, through his own efforts to be a better producer.

Mainly it was a difference in knowledge—in the curiosity to *know* plus the *energy* and *persistence* to get facts and make practical use of them.

"I know no man possessing more knowledge of his business—practical, theoretical, detailed and general—than James A. Farrell," says B. C. Forbes. "When the presidency of the Steel Corporation became vacant, there was little difference of opinion as to the ideal man for the job. James A. Farrell towered above every other figure. He knew every detail of the mining, transportation, and transmuting of ore into iron and steel, of manufacturing all classes of iron products, of how to sell at home and of how to cover the earth with American steel manufactures. And 'Jim' Farrell had one other qualification. He knew how to inspire workmen and win their loyalty."

When did the steel man get this practical knowledge of his industry and of business in *general?* Not after he became corporation president. Not when he was export manager. Not as factory foreman. Not at any one time or in any one job, but all along, starting in as laborer and continuing through each successive position, he was studying business, studying his job and the jobs of the men about him, seeing how they fitted into his company's organization; studying his company, its equipment, methods, and output; familiarizing himself with its problems; studying men and learning how to win their cooperation. It was his knack of going to the root of things that prepared him for one promotion after another and finally placed him at the head of the world's largest manufacturing organization.

Learning Business Day by Day

Charles M. Schwab recently commented on the tendency of American industry to draw its leaders from the ranks, and pointed out the surprising changes which a few years may bring in the standing of workmen who began with equal opportunities and equal abilities. "American industry," said he, "is spilling over with men who started life even with the leaders, with brains just as big, with hands quite as capable. And yet one man emerges from the mass, rises sheer above his fellows, and the rest remain."

Schwab himself exemplifies this truth. He began as stake-driver in the business of which he later became president. Eugene Grace, president of the Bethlehem Steel Corporation, entered the employ of that concern as yard switchman. Thos. E. Wilson, head of the great packing company which bears his name, used to check cattle cars in the Chicago stock yards. Not only in the general administrative positions, but in the lesser executive jobs—in foremanships and in factory superintendencies—the case of Farrell is paralleled in every industry and in thousands of cases.

The Starting-Point for Promotion

Take the recent example in one of the middle-western automobile factories of a foreman whom we will call Miller. He entered the industry as an apprentice in the forge shop, and gradually pushed ahead through various subordinate positions until he became foreman. He was only one among several foremen, and in experience was the youngest of them. Yet, when the superintendency of the plant became vacant, Miller was the instant choice of the management for that important position.

"It is not that he was more brilliant than the others, or a better mechanic," said the president, commenting on this promotion. "All our foremen are reliable workmen, men in whom we have confidence. The difference was mainly a difference in attitude. The other men were faithful to their particular tasks, and were good managers of their jobs. Miller was all that, and more. He was interested not only in producing forgings, but also in making automobiles. He never lost sight of the main purpose of our business—which is not to hammer out forgings, or to bore cylinders, or to assemble transmissions, but *to make and sell automobiles at a profit.*

"His attitude not only prepared him for promotion, but it actually won him the promotion. His keen interest in our business was the thing that first caught our attention—back in the days when he was machinist's helper. We are on the lookout for men who see business as teamwork—who are interested, not only in their particular machine or department, but in the factory as a whole. Miller had that attitude. It led him to study industrial work as none of the other foremen did, and eventually it gave him a broad grasp of production principles, policies, and methods. He had trained himself in the knowledge needed higher up, and at the right opening he was moved ahead to more important work and higher wages."

Success in the industrial plant, as experience shows and as observation will prove to you, is *not* a matter of genius, or of luck, or of unusual opportunity. It comes through loyal, intelligent, conscientious work. It is the result of growth in knowledge, in experience, in character. As later chapters will show, there are qualities that the successful industrial man must possess in body and mind, certain things that he must know and be able to do. But the starting point of all this growth—the necessary beginning of his training—lies in *getting the right attitude toward production work.*

Getting the Right Attitude

The secret of Farrell's success was his attitude. When he accepted the job as laborer, he realized that such work was frequently a blind alley. But it was the best job he could get. What did he do? He didn't settle down in the rut and abandon himself to his fate. Right at the beginning he sized himself up, not as day laborer, but as part of the organization of a factory engaged in the manufacture of wire. He saw his labor as part of the wire-producing process—as necessary in its place as that of the mechanic, and therefore deserving of his best effort. Looked at from this standpoint, even common labor was interesting. He began to ask questions—questions about machinery, about wire-making methods, about factory organization, about the markets. When a man is interested in an activity, he is no longer content to do it simply "according to orders." He wants to know "reasons why."

From this beginning, it was just one upward step after another. There were too many jobs higher up calling for the enthusiasm, the judgment, and the well-rounded knowledge which had been born of his attitude; so he moved ahead to bigger things.

Miller's experience was much the same. It was his interest in the factory as a whole that first attracted the attention of the officers of his company; and it was this same interest that led him to study the job ahead, to see his work in relation to that of the other departments, and to fit his labor intelligently into the whole production.

Production is carried on for a profit. The idea of profit applies not only to factory production but also to individual production.

Production and the Individual

The amount of a man's wages or salary, in the long run, is dependent upon the quality or the quantity of his output. Brain work is better paid than muscle work, because its output is more valuable. It comes higher, just as manganese steel comes higher than iron ore. The steel represents a higher state of preparation and is capable of serving more important needs than the crude ore. Similarly, the trained mind in the factory is more valuable than the trained hand, just as the trained hand is more valuable than the untrained. Each is more valuable because it is more productive—more profitable.

The man who clearly grasps this simple idea and puts it into practise is certain to move steadily ahead to bigger things. It is not a matter of sentiment. It is self-interest and good business. Getting the right attitude toward production is profitable, not only to the business which employs you, but to yourself. It pays in actual results—in increased earning power.

The Cog-wheel Attitude

"I'm only a cog in the wheel," said one thirty-year-old mechanic. What sort of future can such a workman expect? He hasn't enough originality and push, not enough ambition and self-respect, to direct other men. He cannot see beyond the mechanical side of his job, and so he can express it only in mechanical terms.

The cog-wheel attitude is wrong. Compare with it the idea represented by the team. A team member is not a lifeless machine part. To be sure, he must follow instructions, he must obey rules, he must work toward a set goal. But he is an individual, with brains and hands capable of development, with opportunities to increase his producing powe

The cog can never aspire to larger responsibility; the team member can. In fact, if he shows ability, it is almost a certainty that he will be promoted. Said one industrial executive of wide experience recently, "I have rarely known a man who really used his brains to his full capacity and failed to advance."

The team idea is the winning idea. It represents the right attitude toward industrial work—the right attitude for the routine worker no less than for the foreman or other executive. Without this attitude it is impossible to understand modern industry, or to train effectively for success. With it one can go as high as his ambition and energy and persistence will carry. It is the starting point for all advancement.

II

How Teamwork Developed

NOT long ago I was passing through the yard of the great Hog Island shipbuilding plant near Philadelphia when a six-foot, two-fisted fellow in working clothes, with a big smudge on his face that half-concealed a broad grin, stepped out of a passing crowd and called me by name. I hadn't the slightest notion who he was until he explained that he came from an Ohio town and recalled that I had last seen him at the local country club in white flannels ready for a tennis game. He was one of the popular young lawyers of the town.

"Well, Henderson," I said, "you can't blame me for not recognizing you. This is a new kind of a job for you. What on earth are you doing here?"

The Instinct for Teamwork

"Licking the Kaiser," came back the answer like a shot. "I got sick of sitting around in my office with less and less to do, when the whole world was on fire. I wanted to enlist; but that would have meant leaving my wife and babies dependent on charity, and I wasn't ready to do that. So I shut up my office, came down here, and landed this job. There's a chance here to do something real for the country and earn a good honest living at the same time. And let me tell you, I'm never going back. No more law for me. Law is a game in which every fellow plays a lone hand. There's no teamwork. In this job it's just the opposite. I don't like to bicker and fight with people all the time. I want to work *with* them, not against them."

Henderson was only one of a great many professional men who have felt dissatisfied with their part in the war and would like to join hands with other men in putting through some big job. But few have Henderson's courage and independence. It is already clear that he made a wise move. Within a short time he was raised to foreman and later made an assistant to one of the superintendents. So he is doing at least as well financially as he would have done in the law.

The best of it is that he is happy in his job. He has made a place for himself in a big and wonderful team. He is satisfying his instinct —every man's instinct—for working in close and harmonious relations with his fellows.

Usually we fail to realize how deep-seated and ancient that instinct is, and how fundamental *it is* as the very basis of modern production. To make this clear let us go back for a few pages into industrial history.

One is apt to think of factory organization, with its cooperation and time-saving methods, as a recent creation. As a matter of fact, it is the growth of centuries. To understand it fully we must know something of its past and see how it gradually developed, step by step.

The Primitive Age

The beginnings of modern production methods can be traced back to the days of savagery, when man lived very much as the beasts with whom he shared the wilds. This primitive age was the age of complete independence. There was no teamwork. Each man lived and labored and died alone. He was entirely dependent on his own effort to supply his every need—to get food and clothing and shelter, and to protect himself against the dangers which surrounded him.

Today a man usually gets his living by performing certain work for which he receives money that can be exchanged for goods. The actual product of his hand or brain may be of no use to him personally. Assume, for example, that his work is the manufacture of rubber tires. Even if he owns an automobile he can use only a few of them. Yet, by helping to manufacture tires the modern man "*makes a living*" which is infinitely more satisfying, more comfortable, more secure than that of the savage whose every effort was spent in directly supplying his own needs.

The difference is primarily a difference in teamwork. A man today can devote himself to making tires because there are millions of people who want tires, who are unable to make them for themselves, and who are willing to buy the tires that others make. They are busy producing other goods. Some are growing wheat; others are grinding wheat into flour; others are baking flour into loaves and cakes. Some are growing cotton or raising sheep; others are spinning and weaving cotton and wool; others are making cloth into clothing. And so the vast cooperation which is modern business is carried on through a world-wide *division of labor,* by which one worker de-

How one industry depends upon another

votes himself to producing a certain useful product, knowing that the results of his labor will be exchanged for other products which he needs and which other workers are producing.

It is a long journey from primitive times to the present industrial age. Some authorities mark the progress by the character of tools which man gradually developed. Thus it is common to speak of the Stone Age, the Bronze Age, the Iron Age and the Steel Age as steps in the advance from savagery.

More important than tools, however, is organization. Three systems of organization mark the stages of progress:

1. The Family System.
2. The Domestic System.
3. The Factory System.

The first step toward cooperation came with the emergence of some sort of rude family organization from the unorganized condition of the primitive age. The first industrial team, the forerunner of the factory, was the family of prehistoric times—the husband, his mate, and their children.

The formation of even this small group made division of labor possible. With his spear the man ventured forth in search of game. The woman devoted herself to preparing food or to making clothes. As the children became old enough to work, tasks were given them, and so there grew up an organization in which each member of the household performed certain work that contributed to the welfare of all. In short, there was *specialization* of work. With specialization came increase in skill. Five people in a family found that they could get a better living and get it more easily by this method of division of labor than by the old method in which each worked alone.

Birth of the Family System

Compare this first industrial unit with the modern factory. The underlying idea is the same. This idea is that *specialization increases skill and speeds up production.* One hundred men in a watch factory can make one hundred watches in far less time than one man can make one watch. Why? Because in the case of the hundred men, division of labor and teamwork are possible. Each of the hundred does not try to make one watch; each performs a particular function in watchmaking. One is cutting the tiny cogwheels; he cuts all the wheels for the hundred watches, and because he specializes in wheel-cutting he becomes extremely expert. Others are turning the delicate bearings; others are making the cases; and so on. By subdividing the work, each man is able to concentrate on one task. The result is skill, speed, increased production.

The Beginning of Trading

One of the results of cooperation under the Family System was that some families, in time, began to produce more than they needed. Perhaps some combination of fertile soil and favorable weather made one family's yield of grain bigger than usual. Up the river a few miles was another family whose crop had been destroyed by flood; but its winter season of hunting had been successful, yielding a large supply of furs and hides. It was natural for the river group to come to the other group and offer to exchange hides for grain. Such a plan brought advantages on both sides. The hide owners needed food; the grain owners had more food than they could use, whereas they could use the hides. So they traded.

Thus the idea of teamwork spread beyond the family organization and expressed itself in cooperation between groups. In the illustration just given, to be sure, it was largely accidental. There was no organized method of cooperation between the two families. But a start in business relations was made. Communication between groups was established. The advantage of trading was proved. And another step in developing teamwork was taken.

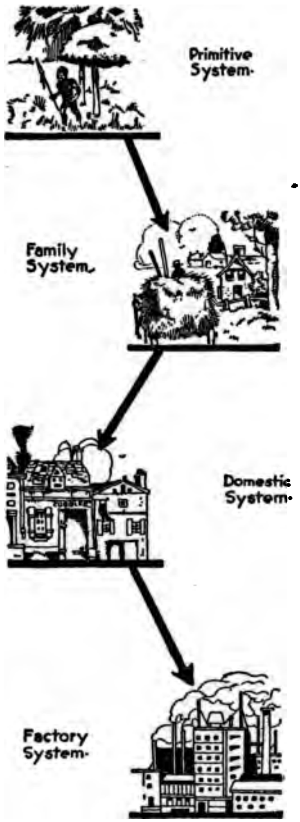
In the course of ages the increase in facilities for exchanging goods made possible a new organization of industry under what is known as the Domestic System.

The Domestic System

Encouraged by the ease with which it could trade its surplus, a group would gradually come to specialize in the production which yielded a surplus. Thus, certain families developed skill in spinning and weaving, and gradually they found it profitable to devote all their time to textile work. By trading textile products to the producers of food and other necessities they were able to make a better living than by trying to produce all these things for themselves.

Each domestic establishment in time became a specialized shop. In the clothing industry, for example, the same family no longer performed all the steps necessary to the production of cloth. One family devoted itself to raising sheep and gathering wool. Another bought the wool from the producers and carried it for sale to the weavers. This group was the forerunner of modern brokers, who serve as middlemen between manufacturers and the producers of raw materials. The family of the weaver devoted itself to making the wool into cloth. Another family, serving as retail stores serve today, bought the finished cloth from the weavers for resale to customers.

Thus the industry of a region became "departmentalized," and the old idea of independent groups was lost in the new idea of cooperation between groups. Here and there the Family System persisted in lone examples. Especially in the thinly-settled agricultural regions the old arrangement of each family directly supplying all its own needs continued. But these were the exceptions. Group cooperation was the prevailing rule of the new age.


Primitive System.
Family System.
Domestic System.
Factory System.

Four Stages in Industrial Development

This age of the Domestic System bridges the period between the Family System and the Factory System under which we live today. In England, the Domestic System had become the prevailing organization of industry by the middle of the fifteenth century, and it continued to prevail until the middle of the eighteenth century.

Perhaps no three hundred years of history mark such advances in commerce as these three centuries. This was the period of great explorations, of the discovery of America, of the opening of the new route to India around the Cape of Good Hope. Colonies were being sent out to settle new lands. The rapid expansion of markets lured the trader on to vaster exploits, and this in turn stimulated the producing power of the craftsmen back home. Roadways were built; ship sailings became frequent; coach lines were established. The people of the world were becoming acquainted with one another, and were expanding their industrial cooperation beyond local boundaries.

One effect of this development was the rise of the cities. The farm ceased to be the industrial unit. Towns sprang up as families drew closer together for greater convenience in trading. The seaports especially became great centers of business. Production tended to more and greater specialization as these centers grew in population and themselves became important markets. Though the

The Six Types of Business

home was still the workshop, industry was now highly departmentalized, and the six types of business which we recognize today were already quite distinct.

That is to say, under the Domestic System you found such specialized types as:

1. Extractive industries, represented by producers of raw materials—farmers, fishermen, miners, lumbermen, quarrymen.

2. Manufacturing industries, represented by artisans and craftsmen—spinners, weavers, tanners, smiths, carpenters, masons.

3. Trading industries, represented by merchants.

4. Financial industries, represented by banks.

5. Transportation industries, represented by caravans, coach lines, ships.

6. Contributive industries, represented by lawyers, physicians, public officials, and the like.

Side by side with the evolution of trade and industry were changes in the social structure. Political equality was slowly emerging. The idea of cooperation was being more and more applied in every department of human life. In some regions progress was more rapid than in others, even as today you find advanced nations and backward nations.

One factor which exerted a profound influence upon business was the guilds. First came the merchant guilds, associations of traders bound together by common business interests, and these were followed by the craft guilds. Craft guilds were associations of artisans, and in time they came very largely to control their branches of industry. The craft guilds sought not only to protect and promote the interests of the working class, but also to promote honest work. Standards were established. Pride in workmanship became a characteristic trait of the guild craftsmen. Pride in his calling and a constant striving for better methods were natural results. Systems of teaching apprentices were developed, and regulations governing entrance to the crafts were established. Business training had its origin in those early efforts to improve and standardize industrial methods.

Merchant and Craft Guilds

By the eighteenth century production had reached a high state of development, trade was highly organized, and many features of the modern factory were here. For example, the working force was not confined to members of the household; employees came in from the outside and worked for wages as they do today.

And yet, in all the world there was not a factory—in the sense in which we use the term today. There were specialized *workshops;* there were *employers;* there were *employees;* there was *congregated labor;* production was carried on to supply *customers.* But there was no factory.

Before the Factory Came

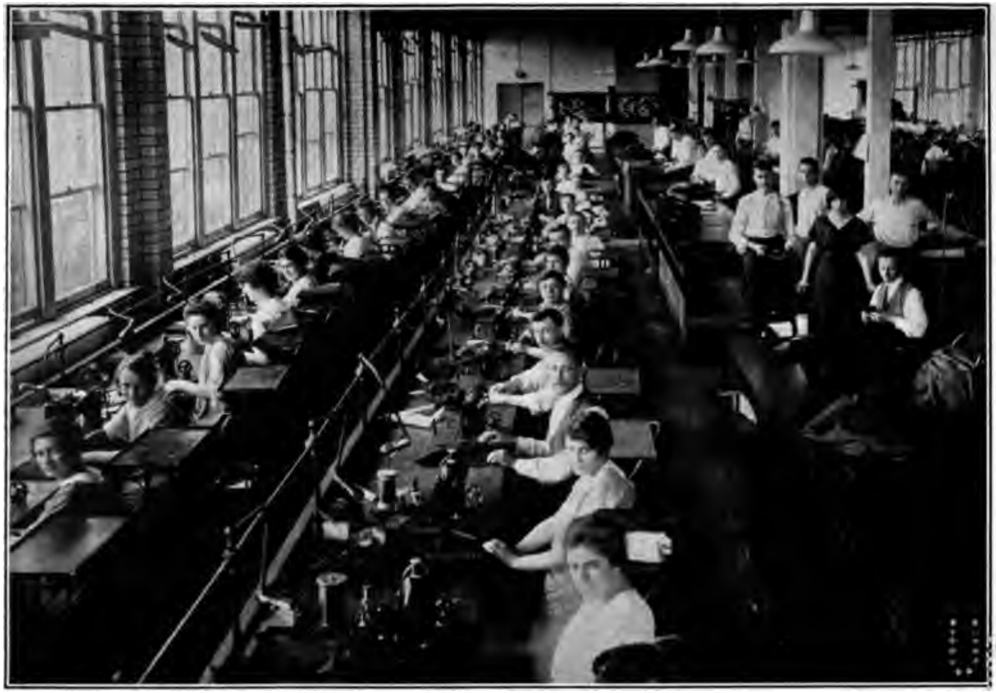
Industry had traveled far. Each age had brought its lessons, added its improvements, and carried man farther along the road of cooperative effort.

The PRIMITIVE AGE introduced him to the forces of Nature, saw him fashion his first rude tools, and taught him the way of self-preservation.

The FAMILY SYSTEM discovered the principle of cooperation and applied it in individual work through division of labor. It demonstrated the advantages of exchange.

The DOMESTIC SYSTEM took the principle of cooperation and applied it to groups. It took the idea of exchange and built up a vast system of trading. It applied specialization, not only in the production of goods, but also in the production of services.

This progress represented the slow growth of thousands of years. Then in the eighteenth century came a series of mechanical inventions—chief among them the steam engine, *the spinning* wheel, and the loom—and within



INTERIOR OF CLOTHING FACTORY SHOWING CONGREGATED LABOR

a single generation the old order of industry was overturned. The factory was here—first located along water-courses for power and later located to suit raw material and market conditions when power could be generated anywhere. So swift was the transition that the events which brought it about have been called the Industrial Revolution.

The Industrial Revolution marks the beginning of the present industrial age. It ushered in the modern organization of business. It made possible the marvelous teamwork and the wonderfully increased production of the Factory System.

III

The Coming of Machinery

MACHINERY was the new element which the Industrial Revolution brought to production work. In place of muscle power it put mechanical power. The result was an enormous gain in output.

A New Element in Teamwork

It was the coming of machinery that changed the manufacturing unit from the household group to the modern industrial plant. Up to the time of the Industrial Revolution (about one hundred and fifty years ago) progress had been mainly in the development of human teamwork. Through century after century of experience men had gradually learned how to organize and how to cooperate with one another.

But so far as machinery was concerned, progress had been slow indeed. Agricultural implements and manufacturing tools were still extremely primitive. Many of them had showed no improvement in thousands of years. The spinning wheel and the hand loom were the most practical mechanical inventions that had been devised. Both were crude hand machines, of limited capacity, operated by foot-power, and dependent directly upon the skill of the persons operating them.

It is true that the power of steam had been discovered, and as early as 1711 had been used to lift water from coal mines. But the steam engine of that time was a rather awkward affair, and little practical use was made of it. The fact is, there were no manufacturing machines for the new power to drive; consequently, for many years the steam engine was lying idle, waiting for invention to harness it to the tasks of industry.

The Industrial Revolution

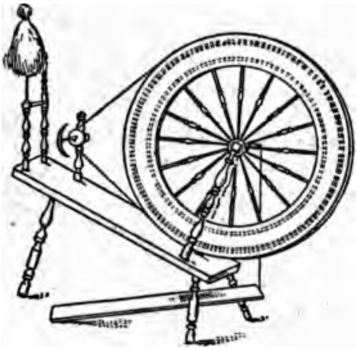
The awakening came in the latter part of the eighteenth century. Beginning in 1764, there followed in quick succession a series of remarkable inventions. The progress of the fifty years thereafter is strikingly pictured in ten important events of this period:

1764—James Hargreaves, a weaver, invented the "spinning jenny."

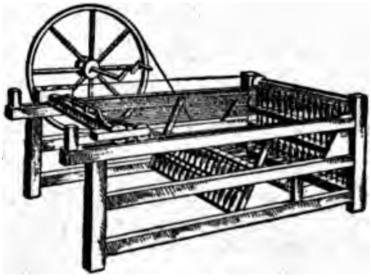
1769—Richard Arkwright, a barber, successfully operated his "water frame," a spinning machine driven by water power.

1779—Samuel Crompton, a weaver, combined the Hargreaves and Arkwright ideas in

The Primitive Hand Spindle



The Spinning Wheel



Hargreaves' Spinning Jenny

a new power-driven machine which he called the "spinning mule."

1782—James Watt, an engineer, patented a double-action steam engine designed for the propulsion of machinery.

1785 — Edmund Cartwright, a clergyman, invented the power loom.

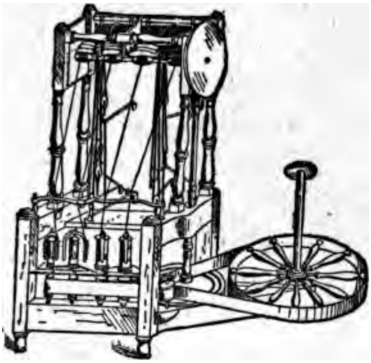
1785 — Watt's double-action engine was employed to drive a textile mill.

1786—Henry Cort, an iron manufacturer, invented the puddling process of converting pig into malleable iron, and perfected machinery for rolling malleable iron.

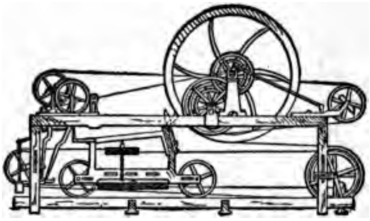
1793—Eli Whitney, a school teacher, invented the cotton gin.

1807—Robert Fulton, an engineer, operated the first steamboat, the *Clermont,* on the Hudson River.

1814 — Robert Stephenson, an engineer, invented the railway locomotive.



Arkwright's Spinning Machine



Crompton's Spinning Mule

The immediate effect of the Hargreaves, Arkwright, and Crompton inventions was to speed up the spinning processes. Yarn was manufactured more rapidly than the weavers, with their old hand frames, could convert it into cloth. A power loom became a pressing need of the times, and Cartwright's invention came in answer to that demand. Similarly, the machines for spinning and weaving called for raw cotton more rapidly than hand pickers could separate the lint from the seed; this led to Whitney's invention of the cotton gin. The increasing use of machinery called for improvements in the production of iron and steel; Cort's invention directly served this need. With trade growing so rapidly as a result of machine production, increased demands were made upon transportation; the invention of the steamboat and locomotive contributed new and powerful agencies as carriers of commerce. Thus, one invention blazed the way for the next one.

Development of the Factory

Within a remarkably short space of time, machinery had been devised to do almost every kind of manufacturing. One machine, attended by a single operative, could turn out more work in a day than a whole team of men. The result was an enormous cheapening of the cost of production. Handicraft workers found it impossible to compete with the machines. Nor was it feasible for the artisan to buy a machine and install it in his home, as had been the case with the tools and implements of the domestic period. The best arrangement was to group a number of machines together and attach them to a single engine.

The Factory System was the natural result of this combination of circumstances. Men deserted their domestic workshops and flocked to the big plants, which, during the latter part of the eighteenth century, were springing up all over England. Communities situated near coal mines or near waterfalls were favorite places for the location of plants, because of their cheap fuel or cheap power. Factory towns developed, whole communities of people working at a single industry—in some cases, in a single large plant.

There had been production by workers assembled in communities before the factory era, but their work was largely individual. Each man brought his own tools, and his rate of production was limited only by his skill in using them. Under the new system tools were for the most part fixtures in the factory, and the rate of production depended partly upon the speed and capacity of the machines as well as upon individual skill.

The coming of machinery affected production (1) in its methods, changing them from handicraft to what is called "industrial" or machine production, and (2) in its organization, changing it from small units, owned by the individual worker, to large units owned by groups of capitalists. Its effect upon organization was shown (*a*) in the rise of capitalism and the development of the corporation, and (*b*) in the development of the idea of profit.

By capital is meant all property used in production. Under the Domestic System capital existed chiefly in the form of land and tools. The artisan as well as the farmer was both capitalist

The Rise of Capitalism

and worker; he owned the tools of production and he performed the labor of production.

Under the Factory System it became difficult for the worker to continue this two-fold function. Instead of cheap hand tools, the equipment of manufacturing was now expensive machinery. If he had money sufficient to buy machinery and equip a plant, the supervision of his investment called for all his attention. If, on the other hand, he was unable to become a factory owner, he usually became a factory worker, an employee of the owner of the machinery.

With the development of business and the consequent growth in manufacturing and trading enterprises, larger and larger amounts of capital were called for. Not only were there larger investments in fixed capital, such as factory buildings and machinery, but also more working capital was required in the form of money with which to purchase raw materials and supplies and meet the demands of payrolls and other current expenses. It became increasingly difficult for one man or even a partnership of two or three men, to supply the needed capital. Gradually a system of group ownership developed, by which many people joined together to contribute the necessary capital for equipping and operating a plant.

Thus, the corporation was born of the need of the factory for capital—a need created by the larger scale of equipment and operation involved in machine production. Though the corporate form has assumed the chief place in modern industry, it has not succeeded in pushing aside the older forms of ownership, so that today you will find operating side by side: (1) the sole proprietorship, (2) the partnership, (3) the corporation.

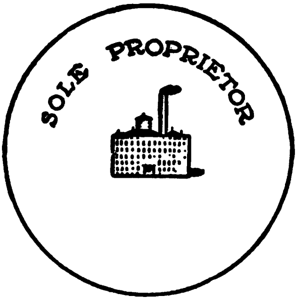
Three Forms of Ownership

In the *sole proprietorship* one man contributes all the capital, owns the enterprise, and is responsible for its success or failure. This form of ownership, which was universal at the beginning of the factory era, is now used mostly for small enterprises involving no considerable investments of money.

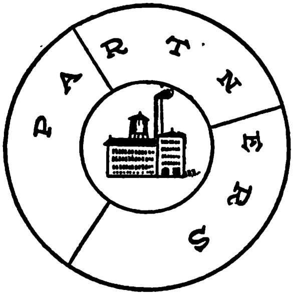
The *partnership* is simply an extension of the sole proprietorship idea. Here two or more owners share in the proprietorship and control according to an agreement among themselves. This form of ownership is largely used by trading and professional concerns.

The *corporation* is an arrangement by which many people share in the ownership of an enterprise in proportion to the number of shares of its capital stock which they hold.

The partnership rests on the basis of a private agreement among partners, and because of its nature the relation is personal and intimate. Each partner is individually responsible of all business acts comitted in the firm name. Only men well known to one another will enter into a partnership; necessarily the number of its members is limited. A corporation, on the other hand, is an organization chartered by the state and subject to state supervision. Ownership in it does not involve such risks and demand such close touch with the business.

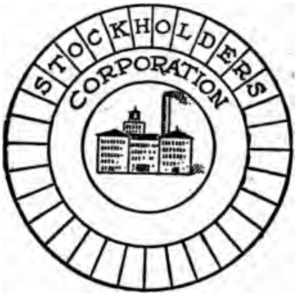


In the sole proprietorship, ownership is held by a single individual



In a partnership, ownership is divided among the partners in proportions agreed to among themselves

From the point of view of industry, the great advantage of the corporation lies in its ability to gather together large sums of money for business purposes. Shares of stock may be in denominations of $100, $50, or even lesser amounts, and this splitting of the ownership into small units enables thousands of people to invest their surplus money and become part-owners in a business. At the same time, the total number of shares is great and provides ample capital. Another advantage is that the death or disability of an owner, which in the case of a sole proprietorship or partnership invariably calls for the winding up of the business, does not affect the corporation. The shares pass through sale or inheritance to another, and the business itself is untouched.



In a corporation, ownership is held by a chartered body, the corporation, which is owned by its stockholders

The corporation has become the dominating form of industrial ownership under the Factory System. Not only great transportation and industrial enterprises, like the transcontinental railroads and the big-scale manufacturing and trading concerns whose capital is reckoned in millions and even in billions, but a large number of smaller enterprises have found the corporate organization the most satisfactory arrangement for financing their undertakings.

Wages and Profit

With the rise of capitalism came the idea of *profit.* Before the age of factories, when the artisan represented both capital and labor, it was not necessary to distinguish the earnings of capital from the earnings of labor. But with the separation of capital and labor in the factory, such a division became necessary. Labor asked for its earnings immediately in the form of a fair wage for its investment of time and energy and ability; and capital asked for its earnings in the form of a fair though delayed return, or profit, on its investment of money.

Capital and profit are not peculiar to the Factory System. They existed long before the first power-driven machine was devised. Rent was charged on land and on agricultural implements very early in the development of organized industry, and the practise of collecting interest for the use of money was common throughout the period of the Domestic System. But the development of factories, with their vast accumulations of capital, and of corporations, with their numerous shareholders, enormously stimulated the growth of these ideas.

Machinery, the Distinctive Feature of the Factory System

What *is* peculiar to the Factory System is the idea of power-driven machinery. To take a process of manufacture that required the close attention and experienced skill of an expert, and to transfer this process to an automatic or semi-automatic machine—that was the distinctive achievement of the Industrial Revolution. It added *machinery to* the teamwork of production.

The early attitude of the handicraft workers toward this change was one of resentment. They saw their jobs being taken by machines. And so there were riots in some of the industrial centers of England. Machines were smashed. Voices were raised in protest against the new movement which was "degrading" labor and "ruining the country."

What these men failed to see was the essential fact that transformed the whole structure of business, and that speedily brought every type of production under the Factory System. It was the fact that *increasing the rate of production cheapens the cost of production.* The introduction of spinning and weaving machines immediately cheapened the cost of cloth, and what before had been only for the rich now came within the reach of those of moderate means. In every industry in which machinery was introduced, it immediately had this effect upon production—it lowered the price, and brought luxuries within easy grasp of all.

Effect of Machinery upon the Workers

Not only were the standards of living raised by the introduction of machinery, but workmen soon learned that by means of machine production they could earn higher wages than had been possible in the old handicraft days. The very fact that machinery was a high-speed, time-saving instrument, made the worker who operated the machine more productive and therefore of greater earning power.

And so, with the rising standard of living came this increase in the earnings of the worker, enabling him to buy his share of the increasing comforts and conveniences of civilization. The watch was a certain badge of wealth a hundred years ago; no ordinary citizen could afford to wear one. Machinery has made it possible to buy a watch today for $1. The bathtub, the telephone, the electric light, the kodak, the Ford—these things are commonplaces today. We own them and use them, little realizing that we are enjoying comforts and conveniences which were beyond the reach of kings a hundred years ago. It is only when we look back and see the forces which have produced them that we realize how vast is our debt to machinery—and to the men who have organized and applied mechanical principles to the work of the world.

Profit is the incentive to production. Machinery is the instrument of production. Teamwork—the teamwork of workers with one another and of workers with machinery—is the method of production. And since the purpose of production is to satisfy human need and desire, this is true: *Every gain in production is for the good of all.*

IV

Factors in Modern Industry

A FEW years ago the officers of a certain American automobile company awoke to the fact that their plant was not making any money. It was a large factory, well situated, equipped with modern machinery, employing 11,000 men, and turning out an average of 175 cars daily. The cars readily found buyers and the company was doing a big business, but practically everything that came in from sales went to pay the costs of production.

Of course the first remedy that would come to mind in this situation is "raise the price." That occurred to the factory management, but the sales department immediately showed how impossible it was. Competition was too keen, the company had built a great reputation on its price, and to raise prices at this stage would be business suicide. Some other way of righting the situation must be found.

The general manager called a conference of heads in the production department. It included the factory superintendent, the chief engineer, the chief designer, the head of the planning department, and a number of foremen. He frankly outlined the situation, showed his aids just how the business had been going, and then told them that the problem was up to the producing end of the business. In other words, since selling prices could not be increased, production costs must be lowered.

Getting at a Production Problem

It was not a question of cutting the wage-scale, the general manager explained, nor of economizing on cheaper raw materials. It was a question of organization, of better adjustment of the teamwork of the factory, so that the rate of production would be increased. It was a question of getting more production out of the plant.

The factory men jumped to that problem. They were production men, every one of them, with a keen sense of teamwork and a just pride in workmanship. If the factory was not making good, they wanted it to make good. It was their business to make it make good. That was their attitude. Of course they were employees; their salaries and wages came regularly; they had suffered no hardships from the failure of the business to earn a margin. But they were sensible enough to know that in an established industry such a condition is not healthy; that it hinders growth; that it is certain to bring failure in the end unless the condition is remedied. So business sense as well as professional pride set them to the task. In the series of conferences that followed every man contributed his part toward working out a plan which in the course of a few months was laid before the directors of the company, approved and adopted by them, and shortly put into effect.

The Result of Planning

What was the result? Three years later that factory was turning out 250 automobiles daily, instead of 175; it was doing this with a force of 6,000 employees, instead of 11,000; it had raised the wage-scale in its plant 11 per cent, had lowered the price of its automobiles 25 per cent, and was making a good profit.

The details of how this seeming miracle was accomplished—how that factory was reorganized, its teamwork made efficient, and its production so enormously increased—make a telling story. By the one item of rearrangement of machinery alone, for example, the floor-space requirements were reduced 10 per cent. By reaching into its scrap-pile the factory saved a clean million dollars a year in waste metal. But all these details can be summarized in a list of three basic factors which were the chief elements in the plan of reorganization, and whose application brought to pass so remarkable a result. These factors, which you will recognize as operating everywhere in business today, are:

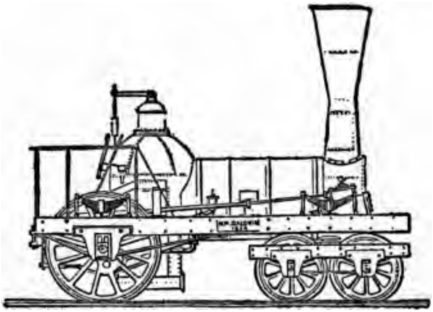
1. Standardization.
2. Specialization.
3. Elimination of waste.

The end sought, the purpose toward which these factors work, is the reduction of cost. The means toward that end is *big-scale production.*

Quantity Production

Big-scale, or quantity, production has come to be a chief characteristic of modern industry. Seventy-five years ago, when the Baldwin Locomotive Works were just getting established, it frequently required an entire year to build one locomotive. Today the Baldwin Works turn out nearly 2,000 locomotives a year, an average of about six for every working day. Watches, which used to be made by slow and difficult processes or individual labor, are now produced in quantities so great as to startle the imagination. A single American company turns out 14,000 watches a day. And so with a long list of other products. Kodaks, typewriters, phonographs, sewing machines, firearms, shoes—as well as automobiles, locomotives, and watches—are now produced not by the piece or the dozen but by the thousand or the hundred thousand.

Under the old handicraft methods of the Domestic System, big-scale production was hardly known. Production costs then were a matter of simple multiplication. If one spinner could spin 100 yards of yarn in a certain period, to produce 1,000 yards within the same time involved hiring nine extra spinners. Each got the same wage, so each of the thousand yards cost as much as each of the hundred yards. The quantity of production did not affect the cost.



Early Type of Locomotive

Decreasing the Unit-Cost

But with the production of machinery, manufacturers found that costs were not so precisely a matter of multiplication. The expense of operating 200 machines is not double that of operating 100 machines, though the effect of the change is to double the output. The larger number of machines may call for twice the number of attendants, but it does not involve doubling the force of firemen and engineers, nor does it call for an equal increase in the outlay for heat, light, power, taxes, rent, insurance and all those other items of "overhead expense" which enter into production.

Thus, a factory making 5,000 articles per month at a total manufacturing cost of $10,000 might find that it could double its output by an additional expenditure of $7,000. Suppose that the selling price for its product is $2.30. On the basis of an output of 5,000 the cost of production is $10,000, or $2 per unit, leaving a profit of 30 cents. On the basis of an output of 10,000 the cost of production is $17,000, or $1.70 per unit, leaving a profit of 60 cents. In other words, doubling the output means in this case doubling the margin of profit.

It was exactly this principle that guided the production men in their planning for the automobile factory: *Increasing the rate of production decreases the per-unit cost of production.* The immediate purpose of all their planning was to lower the cost of producing each automobile; any decrease that could be made would be so much profit gained.

Time and Material

In the factory there are two elements of prime importance: (1) Time, and (2) Material. Idle time and wasted material are the great enemies of efficient production. It is by utilizing time and material up to the highest notch of efficiency that the rate of production is increased and the per-unit cost of production lowered.

Every minute that a machine stands idle increases the burden of expense. The machine represents an investment of money—frequently money borrowed on bonds or notes upon which interest is paid. The interest charge is going on all the time, whether the machine is idle or productive. Every minute that a workman loses at his task lengthens the time required to complete his part of the manufacturing, and so adds to the cost of manufacture. Even where men are employed at piece-work, and it would seem that whether they work fast or slow is a matter that affects only their own pocketbooks, it is the factory as a whole that suffers from slow work. For, those overhead expenses mentioned on a previous page—heat, light, power, taxes, insurance, rent, expenses of administration, and the like—do not slow up with the slow worker. They are piling up all the time; hence the great importance of making every motion and every minute count. In fact, the prime reason for the piece-rate and for the various bonus systems based upon the piece-rate is to encourage more rapid work.

An outstanding example of how a demand for quantity production was met is shown in the ship-building activities of the United States following its entrance into the War in 1917. The problem here was not so much the factory problem of lowering costs as it was the imperative war problem of turning out ships as rapidly as possible. But the methods pursued were the tested methods of the factory—the same methods which had already worked in the automobile factory, the locomotive works, and the watch factory.

Standardization

The basic factor in these methods was *standardization.* Instead of handling each ship as an individual job, calling for its own special design and for individual treatment, the government's authorities decided how many ships of a certain tonnage should be built, adopted a standard design for all ships of that size, and were then able to proceed with quantity production. If 1,000 ships of one design were to be built, it meant 1,000 engines of exactly the same type and size, 1,000 rudders just alike, 1,000 propeller systems, and all the material for 1,000 hulls, with complete equipment, fitted together in the same way.

You can see how such a policy would speed up production. Standardization made the task of building the 1,000 ships not 1,000 separate jobs, but one job. The makers of steel plate for the hulls were able to concentrate on their part of the job. An order of such size made it possible for them to install time-saving machinery to stamp and cut the steel in exactly the right dimensions. Similarly with the makers of other parts. The workmen, through concentration upon a standardized process of manufacture repeated many times, gained additional skill and speed in their work.

Specialization

Standardization calls for *specialization.* It tends to narrow the list of products. Too great variety of standard articles would defeat the very purpose of standardization, for it would increase the number of manufacturing processes. Thus the government's policy in shipbuilding was to adopt a few standard types, and specialize on these. This policy has enabled the Ford Motor Company to turn out 2,000 automobiles a day. Its big-scale production and small per-unit cost are the direct result of its specialization upon a very few types of cars. It was this policy that guided the government in its adoption of a standard motor for airplanes and of a standard machine gun for the army. Concentration upon a single product permits great division of labor, specialization in the production of parts, and increased rate of production.

Textile mills apply the same principle when they specialize on a few weaves of cloth, turning out enormous quantities of each. Similarly with shoe factories which specialize upon one or two grades of shoes. It is applying on a big scale the familiar truth that you can accomplish more and do it in less time by concentrating upon one line of work than by scattering your efforts over several lines.

Interchangeable Parts

Standardization brought *interchangeable parts*. Since each ship-part was standard, it would go equally well on any one of the 1,000 ships. This meant a great advantage in fitting the parts together. No need now to set aside a certain shaft for ship No. 5; the shaft was standard and would fit any vessel, from No. 1 to No. 1,000. Thus each part would be made in quantity and kept in stock, ready for the day when it was to take its place in the fabrication, or putting together, of some vessel. It is from this that we get the expression "fabricated ships."

In the watch factory and in the automobile plant watches and automobiles are "fabricated" in much the same way. Time is thus gained both in the big-scale production of

ASSEMBLYING ROOM OF AN AUTOMOBILE FACTORY

parts, and in the assembling of these parts into the finished product.

Standardization brings its advantages not only to the producer, but also to the user of the merchandise. The Ford owner in Manilla can obtain in his local agency or repair shop the duplicate of any broken part. The typewriter which breaks a key or loses a tiny bar no longer must be sent back to the factory for repairs; the needed part can be obtained, and it will fit because it has been made standard and is interchangeable.

Elimination of Waste

But the saving of time is not the only item that affects production costs. There is that other element, material—the raw material which goes into a product and which represents a considerable portion of its cost. Modern industry discovered that much of its profit was being lost through sheer waste—through loose methods in the tool room and in the stock room, through faulty storage and inefficient handling, and through the failure to make full use of material. Hence that other factor in modern industry—*the elimination of waste.*

In the early days of the oil industry, for example, gasolene was a troublesome byproduct which the refiners turned into creeks or got rid of as best they could. Today practically every element in crude petroleum is utilized. Cotton seed, after the removal of its lint, used to be thrown out or was burned. Now it is pressed for its valuable oils, and what remains is used as stock feed. In the packing plant today not an ounce of the slaughtered beef is thrown away; even the horns, the bones, the blood, and the hair are utilized. Mr. Armour used to say that he used everything in a pig except the squeal. In the machine shop the metal filings and scrap are carefully swept up and remelted. The lumber mill uses its sawdust as fuel.

This principle of eliminating waste is applied not only in making use of what had been thought to be useless, but also toward reducing the spoilage of material. It is applied toward the reduction of every element of waste within the factory—waste floor-space, waste machine-time, waste labor, waste power, waste supplies. Everything which enters into the operation of the factory is an element in the cost of production, and the waste of any element is a drain upon the production. It is a proverb of the Standard Oil Company that the profits of the business are in its economies.

The great advance which the last few years have brought in increasing the output of production is the result of science applied

How Science Serves Industry

to industry. The old idea of science was a thing of text-books and musty lecture-halls and mysterious laboratories. It was something apart from the practical everyday life of the shop, the factory, and the counting room.

But today, science is the right hand of industry. It has taken the wasteful, slow-moving engine of Watt's time and developed the giant Corliss engine and the powerful turbine engine. It has harnessed the lightning, and added the power of electricity to that of steam; the electric dynamo, motor, telephone, telegraph, and arc and incandescent light have not only cheapened industrial processes but have decreased the dangers of factory work. It has added petroleum to the driving power of industry, developing the internal combustion engine driven by gas or gasolene. It has applied the laws of chemistry and physics to the work of the world, developed instruments of precision, and made possible that mechanical accuracy without which standardization would be impossible.

In the single field of steel manufacture, for example, the application of chemistry transformed the business from the hit-or-miss program of guesswork to the certainty of a chemical formula. Charles M. Schwab tells an amusing story of Captain Bill Jones, the famous works-manager of one of Mr. Carnegie's mills. "I remember very well," says Mr. Schwab, "the first time the Pennsylvania Railroad specified that the rails we furnished should be of a certain chemical composition. This alarmed the old captain. He had never heard such names as carbon and manganese. 'Charlie,' he said to me one day, 'this damn chemistry is going to ruin the steel business yet.' "

Many of the large industrial concerns maintain experimental departments. Here trained scientists are employed in constant investigation and testing, in the hope of working out improvements which will add to the plant's productivity. A single scientific discovery, like that of the Bessemer process of making steel, has increased the output of production many times. The enormous cheapening of steel which resulted from this improvement in the manufacturing process, is largely responsible for the extensive use of steel in bridges, skyscrapers, and other construction.

Modern Production Calls for Brain-workers

Thus the course of industry in every line has been in the direction of (1) greater standardization, (2) higher specialization, and (3) more complete elimination of waste, through the application of science and in-

Hydroelectric generators in power plant in China. Each generator is capable of developing 10,000 h.p., 115,000 volts

Each spinning frame in this modern textile mill is geared direct to its individual electric motor

THE APPLICATION OF ELECTRICITY TO INDUSTRY
HAS BROUGHT ECONOMY AND EFFICIENCY

vention to the problems of production. You might sum up all three factors in one phrase: *closer and keener thinking about production methods*. Machinery, factory organization, time-saving systems—all these are creatures of the brain of man, and man still remains the prime element in production.

But he is a different kind of man from the old handicraft worker. He is more of a brain-worker and less of a muscle-worker. Machinery takes the place of muscles, but it can never take the place of brains. Machinery is simply the instrument with which brains work—a more complicated tool than the old hand implement, but still a tool, a thing to be used. Because it is more complicated, its use involves more brain-work—more thought in organization, operation, and management—greater thought and skill in cooperation.

And so it is that the modern factory calls for brain-workers rather than muscle-workers. Muscle work is cheap and must forever remain cheap, simply because it is so inefficient. Harrington Emerson has said that "thirty men, as men work, will yield one horse-power of energy each hour; but so will one to five pounds of coal. A ton of coal may be assumed to have the energy of five men for a year." It needs only a swift comparison between the wages of five men for a year and the cost of a ton of coal to show why steam and electric power have so largely taken the place of muscle power, and why muscle power, when it is used, gets low wages.

Brains Have No Rival

On the other hand, brains command high wages. They have no rival in the field. None of the marvelous machinery which the automobile factory had in its equipment was able to solve its problem of how to lower costs. It took the brains of the production men to do that—the brains of those who planned coupled with the brains of those who put the plans into effect.

The greater and more highly-developed the teamwork, the greater the degree of intelligence required of team members. This is why modern production calls for brain-workers in every department and in every position. It is the highest development of teamwork that we have; the most specialized; the best equipped.

Capital there is no lack of. The markets are world-wide and their demand for production is enormous. What captains of industry are everywhere looking for is brains—trained minds of men and women who will enter into this teamwork wholeheartedly, who will deliberately set themselves the task of making their part of production 100 per cent efficient.

There is no danger of such people being displaced by machines. There is no danger of such people being ground down, or losing their identity in the mass. They are wanted. They are needed. Brains are at a premium today. Industry is not only willing but eager to pay the price, for the success of its teamwork depends upon the brain-work of its employees.

V

The Business as a Unit

NOT long ago a certain sewing machine company had a factory superintendent whom we will call Pierce. Pierce was a thorough mechanic, a man who had a knack for machinery and got genuine pleasure out of working with it. He had also that other and rarer gift—the knack of management, the ability to direct men and win their loyal cooperation. As a production man he seemed to be a complete success.

A Man with One Idea

But when you went on the inside of the business you found a different story. There was no belittling Pierce's ability. He got the work done, the sewing machines came out at a high rate of production, and he kept costs down to the lowest. But there are other considerations in a business than production. There are problems of sales, for example. Pierce called these "outside matters," and because they seemed foreign to his department he ignored them.

"Any improvement which was suggested because it would help sales was certain to be opposed by Pierce," said the sales manager. "For example: We had a suggestion from several dealers pointing out that a slight change in the design and placing of the balance wheel would enable our sewing machine to be attached to a motor and driven by electricity. Small motors were being manufactured by the electric supplies people and advertised as aids to the housewife. Here was a chance for us. This added convenience in our machines would give us a strong selling point.

"Yet, when the matter was put up to Pierce with the suggestion that he have a sketch prepared, he flatly turned it down. Said we were in the sewing machine business, and not tails to the kite of any electric motor manufacturers. When pressed he argued that such a change required readjustments in some of the factory machinery, which would cost money. Moreover, the improvement would add nothing to the mechanical ability of the product; it would not make a better sewing machine; therefore it was ridiculous to consider.

"It was only after this thing had been threshed out in our executive conference and was approved and authorized by the heads of the company, that Pierce would touch it. Then, when it was no longer within his power to block the proposal, the superintendent took up the task with characteristic energy and ability, and pushed it through in short order. The change cost some money, but the added sales which we got and the great gain which we won in good will as a result, many times made up for the cost."

Manufacturing is Only Part of the Business Teamwork

From this incident, which is typical of many such tilts that occurred between the head of production and the heads of other departments, it is easy to see wherein Pierce's fault lay. It was in his *one-sidedness.* He was blind and deaf to any interest outside his own department. He never seemed to realize that the factory itself was not the whole business; that it was just one part of the whole; that the real unit was the sewing machine company with its various operating departments.

The great gain which came to industry through division of labor and specialization has been pointed out. But in this very fact of specialization there is a danger of becoming one-sided, of becoming so engrossed in one's own department that the main purpose of the work is lost sight of. That is what happened to Pierce. He had so concentrated on production, that nothing else existed for him in that business. The purpose of his work, as he saw it, was to make sewing machines, and to keep on making them at as low a per-unit cost as possible. Whereas the real purpose of his work was to make sewing machines that would please customers and earn a profit.

Looked at from this standpoint, the teamwork of the various departments and of all the men within the departments is easily understood. Each department and each man has particular tasks and individual responsibilities. The factory superintendent is responsible for keeping down factory costs; the sales manager is responsible for keeping up and increasing the volume of sales. But if keeping down costs means refusing to add needed improvements, the factory will soon find the demand for its produce falling away. If keeping up the volume of sales means selling goods on insufficient credit, the factory will soon find itself in financial difficulties. So there is an interest higher than keeping down costs or keeping up sales. It is the task of keeping the business productive as a whole—that is to say, profitable.

Internal Organization

When we come to analyze the operation of a business enterprise, we find that it involves an organization of teamwork which in its main outlines is the same for practically every type and form of business. It may be a manufacturing concern, a trading establishment, or any one of the other types of industries; it may be a sole proprietorship, a partnership, or a corporation. Whatever the type and whatever the form of ownership, its successful operation involves five distinct functions:

1. Producing.
2. Selling.
3. Financing.
4. Accounting.
5. Management.

Producing

Remembering that profit—the sale of its goods at a fair margin above their cost—is the purpose of the business, it is clear that the first step is the *production* of the goods. The petroleum company must first get the oil out of the ground; the watch company must first manufacture watches; the retail store must first procure merchandise; the railroad company must first operate trains and produce transportation; the bank must first accumulate financial resources; the engineer's office must first acquire technical knowledge. Each must produce before it can sell any article or any service to customers.

And so, the internal organization of a business must include a department whose main purpose is to look after production. In the manufacturing business, the factory itself is the producing department. Naturally, such an organization varies with the size and character of the production carried on. The production department of a large automobile company or a ship-building company is a complex structure, with numerous subdivisions; the production department of a gas company or an electric power company, whose product is made by a simple continuous process, is usually a very simple organization. The detailed makeup of a typical factory will be illustrated and discussed in Unit III, where the organization of industrial production is taken up.

Selling

Production must be followed by *selling.* And just as the organization of production varies with the size and character of the business, so with the organization of selling. Some manufacturing concerns have only small selling organizations. They may dispose of their entire output in a few large lots to jobbers or other wholesale dealers; sometimes they manufacture under contract to others who look after the distribution and sale of the goods. Such manufacturers of course have few sales problems as compared with those who because of competition or the character of their goods or markets must make direct appeals to buyers, organize sales and advertising campaigns, and actually win customers.

The selling function is most prominent in trading organizations, especially retail stores; but there are numerous manufacturing concerns which maintain large sales organizations. The United States Steel Corporation, the Standard Oil Company, the International Harvester Company, the Victor Talking Machine Company, the Underwood Typewriter Company, the United States Rubber Company, the National Cash Register Company —to name only a few—are typical of a long list of big-scale industries in which sales effort is highly organized and expertly administered.

But whether it be by one man or by a department of five thousand experts, the sale of the factory's output is essential to the success of its business. This calls for a close relation between the two departments. The production department must be guided by the sales purpose of its production. It must frankly recognize that goods are made to sell; which means that they must be so made that they will attract customers, please customers, satisfy customers, and build good will.

Financing

In the processes of producing and selling, capital is required. Money is needed not only to provide the fixed capital in the form of plant, machinery, *furniture,* and other fixtures, but also to provide liquid or working capital for the purchase of materials and supplies, the payment of salaries and wages and other current expenses. Because money is so continually needed, the function of *financing* occupies an important place in the operation of every business. Borrowings must be made from time to time; the credit of the business must be safeguarded; collections must be made regularly. It is clear that bad judgment in borrowing, such as accepting an interest rate above what could be had elsewhere or agreeing to burdensome terms, might easily wipe out a profit earned through careful production and sales management.

Accounting

The conduct of any business involves records. Account must be kept of the possessions of the business and of its debts; of its expenditures and of its sales; of its profit and of its loss. Without adequate records, the business man would not only be in the dark as to his present standing but he would have no guide to direct his planning for the future. Thus, one of the essential functions of a business is *accounting.* Within recent years accounting methods have been increasingly applied to the factory, in the effort to make production costs less of an estimate and more of an actual record. The fifth Unit of this Course will go into the subject of production records in detail and make clear the specialized accounting which serves the factory.

Management

Finally, all these functions must be coördinated. That is to say, they must be kept in tune with the main purpose of the business. Without some authority above all departments and superior to all, each department might become self-centered. And so the final function is *management,* or administration. It gives unity to the business. It prevents the demands of one department from overshadowing the interests of the whole; it prevents the failure of another department to press its needs, to work to the injury of the whole. The management is the centralizing and harmonizing function of the organization, the stabilizing governor which keeps the business machine operating smoothly and productively in all its parts.

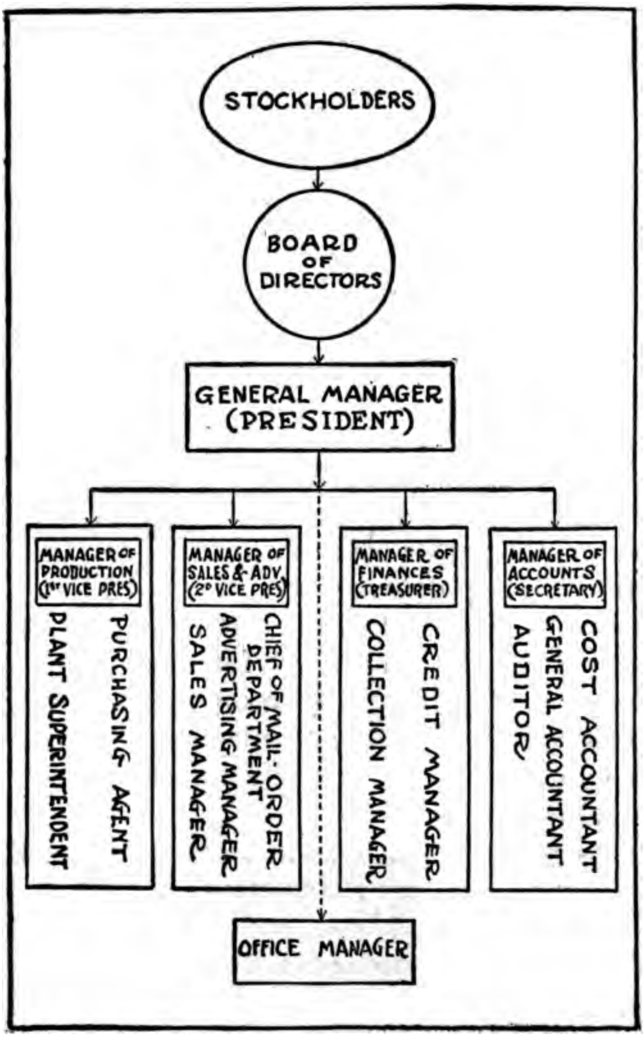
We have spoken of each of these functions as represented by a "department." In small concerns this separation of functions does not exist. For example, the sawmill owner in the backwoods of Michigan may himself look after the general management of the mill, keep its books, sell its production, and attend to its financing. But as the industry grows he would find it impossible to look after all ends of the business. In time he would hire a bookkeeper, perhaps employ someone to take charge of the sale of his product, and attend to the management of production and of finances himself. Finally you come to the large-scale business, in which each of these functions must be cared for by large groups of specialists, all departments reporting back through some central authority to the owners of the enterprise.

Organization under the Corporate Form

The most usual form of ownership of an industrial enterprise, as an earlier chapter has pointed out, is the corporation. In order to see the organization of such a business and the relations existing between its owners and its operating departments, let us study the enterprise outlined in the chart on page 64. This is organization chart for a small New England manufacturing company, and has been selected because it illustrates without too much detail the lines of authority and the separation of functions.

As the chart shows, the organization consists of four groups of factors:

1. Stockholders.
2. Board of directors.
3. The general management.
4. Four coordinate departments:
    - *a.* Production.


STOCKHOLDERS
BOARD OF DIRECTORS
GENERAL MANAGER (PRESIDENT)
MANAGER OF PRODUCTION (1ST VICE PRES)
PURCHASING AGENT
PLANT SUPERINTENDENT
MANAGER OF SALES & ADV. (2D VICE PRES)
CHIEF OF MAIL-ORDER DEPARTMENT
ADVERTISING MANAGER
SALES MANAGER
MANAGER OF FINANCES (TREASURER)
CREDIT MANAGER
COLLECTION MANAGER
MANAGER OF ACCOUNTS (SECRETARY)
COST ACCOUNTANT
GENERAL ACCOUNTANT
AUDITOR
OFFICE MANAGER

AN ORGANIZATION CHART

b. Sales and Advertising.
c. Finances.
d. Accounts.

Stockholders

The *stockholders* are the owners of the business. They have put up the money to equip its plant and provide operating capital; whatever profit is earned goes to them, and in case of failure the loss would be upon them. Frequently, a company's stockholders are a large body, scattered over a wide territory. This is the case especially with big concerns like the United States Steel Corporation, the General Motors Company, the Pennsylvania Railroad, and the General Electric Company, each of which has a stockholders' list numbering several thousand. On the other hand, there are many companies whose stock is held by a very limited number. Sometimes a small group, three or five persons, will organize under the corporate form rather than the partnership because of the advantages to be enjoyed under that arrangement.

Usually, though, the corporation consists of a number of shareholders, many of whom have interests in other lines as well, and few of whom are able to keep in close touch with the business. So, instead of all undertaking to supervise the affairs of their corporation, they select a small committee of themselves, a board of directors, and intrust the conduct of the business to this board.

The Board of Directors

The *board of directors* is elected, usually annually, at a meeting of the stockholders. The number of persons on the board varies; it must have at least three members, and sometimes numbers as many as twenty-five. The board is given full power to operate the business, though of course it must render a report to the stockholders at their yearly meeting and receive authority for any proposed changes in general policy.

The board elects officers from its body. Always there is a president, secretary, and treasurer. Sometimes the offices of president and treasurer are combined in one man; sometimes secretary and treasurer are one. Frequently there is a vice-president or several vice-presidents. In the corporation whose organization we have charted on page 64 there is a president, two vice-presidents, a treasurer, and a secretary. At the meetings of the board of directors the president is the presiding officer, with the vice-presidents serving in turn in case the president is absent; the treasurer keeps the financial records and funds; and the secretary keeps the records of meetings and serves as corresponding officer of the corporation.

So much for the board of directors. It is the representative body of the stockholders, acting with the full authority of the stockholders, and at its board meetings—which may be held monthly, weekly, or even oftener—passing upon plans, deciding upon policies, and in general indicating the lines to be followed in the operation of the business.

The General Management

Under the board are the operating departments, headed by the *general manager.* The general manager is the supervising head of the business, the executive through whom the authority of the board passes to the various department heads. His department is frequently referred to as the administrative office, or the general office.

In the business which we are examining, the president of the company is general manager. This is not always the arrangement. Frequently the president has a subordinate general manager, the president being the general administrative head of the business and the general manager having special supervision over the main operating department. Thus, in many large industries where manufacturing activities dominate, the general manager may be the name by which the manager of production is known. In such cases he is frequently a technical man pure and simple, and has no seat in the board of directors.

The Operating Departments

Subordinate to the general or administrative offices are the four specialized departments. The functions of these departments have already been discussed, and are indicated in brief on the chart. Thus, under the *production manager* are (1) the purchasing agent, who buys materials and supplies for the factory, and (2) the plant superintendent, who is directly responsible for the operation of the plant. Under the *sales manager* are three subdivisions, (1) mail-order sales, (2) general sales, (3) advertising. Under the *manager of finances* are (1) the department which passes upon all applications for credit, and (2) the department responsible for collecting the company's outstanding accounts. Under the *manager of accounts* are three subdivisions, (1) that of accounting, which keeps the general accounts of the business; (2) that of cost accounting, which keeps the records of costs; (3) that of auditing, which checks up the records of the other departments.

Here again it must not be assumed that the exact details of this organization are standard. For example, in the company under consideration the heads of operating departments are officers in the corporation—the two vice-presidents being in charge of production and of sales; the treasurer, in charge of finances; and the secretary, of accounts. As was remarked in the case of the general managership, these positions are frequently filled by persons outside the board who are employed especially for the purpose. Even where officers of the board are also department heads, the combinations are not always as indicated in this example. Thus, the treasurer sometimes has charge of accounts in addition to credits and collections. A more usual arrangement in the case of large corporations is to have a special executive, the controller, as the accounting head; and in conservative British practise the controller reports not to any officer but direct to the board of directors.

The office manager, a subordinate position as indicated on our chart, is in charge of the general office routine—the clerical and stenographic force and other employees of that office. In this organization he reports to the president. A frequent arrangement is to have the office manager under the secretary.

Thus, we have these four groups. The first two, the stockholders and the directors, represent the ownership and exercise control over the business; the other two groups, the general management and the specialized departments, operate the business, putting into effect the plans of the directors.

Employer and Employee

Two relationships stand out: (1) that of owner, or employer, and (2) that of operator, or employee. The board of directors, made up of selected stockholders and bearing authority direct from the whole body of the stockholders, chooses the executives of the company and, it may be, the heads of the departments. The choosing of under executives, of assistants, foremen, and workmen is usually left to the department heads themselves. Many of the big concerns have special employment departments which examine applicants for work, and determine their fitness.

But whatever the arrangement, you find the lines of authority passing down. The board selects and employs the higher executives, the higher executives chose their assistants, frequently the assistants choose those who make up the rank and file.

Thus, everybody within the operating departments of a business, including the higher executives, is really an employee. The president may own a number of shares of stock in the corporation, but as president he is an employee. The fact that his salary is larger, and his authority over the business greater, does *not* distinguish his position in principle from that of the humblest employee. He is simply one member of the business team. As the leader of the team he may be called "boss," and in this relation those under him look to him as employer. But he too is an employee, and as such is responsible to the real boss, the body of stockholders represented by their board of directors.

Thus, viewed from every standpoint, the business organization is seen as a finely balanced teamwork in which all parts are operating toward one goal. The goal is profit. The stockholders provide the capital which supplies the equipment and working funds of the business. The employees, working under the general direction of the board of directors and in their various departments under the immediate direction of the executives, provide the labor of hand and brain which uses this capital in profit-making ways. Each group is necessary to the other.

"Productive" Work and "Non-productive"

Moreover, each department within the business is necessary to the real success of the other departments. There is a tendency to speak of work which brings in visible returns, such as the manufacturing activities or the selling activities, as "productive," and to brand the other activities as "non-productive." Of course such an attitude is wrong. It violates the fundamental principle of organization—the principle of teamwork. The clerk whose work is checking orders is just as essential and "productive" a factor in the work of carrying on the business as the salesman who got the orders. The time clerk who keeps the records and the mechanic who makes the records are both essential factors in efficient operation.

The right attitude sees every essential work as productive. Every man and woman in the business is a producer; each contributes to the teamwork which produces goods or services and gets them to customers at a profit.

Moreover, every man and woman in the business is a salesman. Whether they are actually in the selling department or not, they are constantly influencing sales. Slipshod work in the factory may make a disgruntled customer, and kill the effect of many dollars' worth of advertising. Grouchiness, ill-humor, indifference, unfairness—these traits noticed in an individual often prejudice an outsider against the business which employs him. The opposite traits, even in an office boy or a day laborer, will win confidence and attract trade.

Every employee can boost for his business, if he has confidence in it—and he should work for no concern in which he does not have confidence. It is his duty to boost—to let others know the good quality of his company's product and the high standard of its organization. It is to his interest to boost—to build good-will for the business in which he is an essential part, and in whose future his own success is bound up. He will boost—if he has the right ambition and the right conception of his part in the business.

VI

Human Nature in Production Work

"THE biggest problem in running our business," said the president of a large Ohio industry, "is not supplying the capital, or getting the raw material, or finding the markets.

The Factory's Biggest Problem

"All these are important and require careful management—for we are constant borrowers of money, have had our troubles with a shortage of raw material, and are faced with pretty strong competition all along the line. But the problem that is always uppermost is the problem of supplying man power, of keeping our factory team fully manned and properly officered. It is not a question simply of employing applicants for jobs. It is a question of getting the right sort of men and women and fitting them into the jobs.

"We are everlastingly on the lookout for signs of leadership and executive ability. None of our 3,200 employees are more anxious for promotion than we are to promote them—for the jobs higher up are the jobs most important to us. That is why we are so careful in filling them. Technical skill and knowledge are not enough. Experience is not enough. There are certain personal traits and characteristics that the foreman and superintendent must have, and which we look for and encourage wherever we find them. Loyalty, for example, and tact, and a sense of fairness. These things count very high with us, for we have discovered that a foreman who lacks any one of them sooner or later fails in his job. We save the cost of labor turnover and give stability and character to our organization by testing our men fairly on all points of personality as well as on points of knowledge and skill. All promotions are based upon the result of such tests."

The merit of this company's system seems thoroughly proved by its record—the exceptional organization which it has built up and the high rate of efficiency which it has achieved. Nor is the idea an original one. Many other concerns have similar systems in force. Business is more and more coming to realize the important part which human nature plays in industrial efficiency. Production is no longer thought of in terms merely mechanical. The factory is no longer thought of as just an aggregation of machines. Industry realizes today as never before that back of all machines, back of all systems, there is the human element with its variations in ability, character, and temperament.

Seven Types of the Business Man

It takes only a moment's survey of a list of your acquaintances to prove that there are wide variations in human types. Certain people seem naturally fitted to do certain work; others fail miserably at that work, but succeed when they apply themselves to other work adapted to their type of personality. A recent treatment of this subject has classified seven distinct types of the business man: (1) the technician, (2) the artist, (3) the salesman, (4) the trader, (5) the financier, (6) the organizer, (7) the administrator.

There are basic traits which are essential to success in all lines, and which successful men of all seven types share in common. Yet each type differs in some degree from the others; each has its special line of development. The technician, who may be a mechanic in the factory or a trained accountant in charge of the office records, is a precise worker. Thoroughness is an outstanding characteristic of the technician. The artist type, represented by the architect and the inventor, needs an unusual degree of imagination and vision. The salesman has energy, enthusiasm, and power of expression. The trader type is marked by broad knowledge of business, careful judgment, quickness in decision and action. The financier possesses three traits to an unusual degree: analysis, foresight, and prudence. The organizer has a sure knowledge of business, great power of observation and concentration, and highly developed reasoning power. The administrator too is a sound reasoner, and he possesses strong power of leadership—of stimulating the loyalty and enlisting the cooperation of others.

We have spoken of the mechanic as a technician. And yet, this type does not include all that we look for in the ideal production man. He must be more than a skilled worker, more than a thorough master of his machine or process. To succeed completely in production work he must be able to handle that other element in the factory—the human element. He must be able to put plans into effect, not merely through engineering machinery, but also through engineering men. The good production man is a combination of two types—he combines the qualities of the technician with those of the administrator.

Combine the two types and you have a man who has thorough technical knowledge and skill and possesses the knack of leadership. He knows men as well as machines. He has a strongly developed sense of teamwork. He has certain characteristic qualities of body, mind, and character. These distinguishing and necessary characteristics of the production man have been listed under twelve heads, as follows:

Traits of the Production Man

1. Physique.
2. Energy.
3. Thoroughness.
4. Observation.
5. Concentration.
6. Judgment.
7. Loyalty.
8. Fairness.
9. Tact.
10. Control.
11. Mechanical ingenuity.
12. Knowledge of production methods.

Physique

The term *Physique* covers all qualities relating to physical fitness. It means a sound and healthy body. The man who is sickly or physically weak from any cause has a tremendous handicap to overcome. He cannot concentrate upon his work. Only by the exercise of unusual will power can such a man be thorough in his work. It is true that some suffering from ill health have succeeded, because of their superior will power, nervous energy, and mental ability; but they are the rare and exceptional cases. Certainly, the demands of production work can scarcely be met under such handicaps, no matter how brilliant the brain power of the man.

Size is not necessarily involved in this question of physique. Both Andrew Carnegie, the great steel maker, and E. H. Harriman, the great railroad administrator, were men of small bodies. Carnegie took care of his health and lived to retire from business at a ripe old age, whereas Harriman overtaxed his physical machine and died in his prime. The difference was a difference in health. There may be merit in the argument that a big body is an advantage to the executive because it gives him an appearance of greater power and ability, and thus strengthens his control over others. But the list of small men who were leaders is a very impressive one, and includes some of the greatest in history. Your physical size is a quality which cannot be altered and for which you are not responsible. Your health and physical fitness can be controlled. It is these elements in physique that call for frank analysis and close attention. The senses of sight and hearing are especially called upon for service in the factory, and their quality should be known to a certainty. All your development of mind and character, all your ability in technical work and in the control of others, must rest upon the foundation of a good physique—a sound body, health, and normal physical faculties.

Energy

Physique is not enough. Many a man of sound body and perfect health is incapable of doing good work, and there is just one word to describe his handicap; it is laziness. Many a man has lost his chance of promotion because he was slothful. The willingness and the ability to work have often been deciding factors in promotion. Alvah C. Dinkey, who started in as a water boy and became president of the Carnegie Steel Company, won the early recognition of his employers by his industry. "His rise," says Charles M. Schwab, "was predicated on his willingness to work as long as there was any work to be done."

This quality of industry which vitalizes a strong healthy body and makes it an active instrument is called *Energy.* The production man must have energy. He must have the driving power which carries him on to the day's tasks, and which by its example inspires and stimulates those with whom he works.

The outstanding characteristic of the technician is *Thoroughness,* and this quality enters very largely into the makeup of the good production man. Not only must his working methods be precise and accurate, but his handling of any situation in the factory must be thoroughgoing and complete. Thoroughness implies no loose ends, no neglected corners, no forgotten details. The thorough man has the power of endurance, he is reliable and steady, he has persistence. The thorough man never is content with a job that merely looks all right; he demands that it be all right, both inside and on the surface. The quality of thoroughness not only assures good work from the man who is thorough, but it inspires others to confidence in him and goes a long way toward winning the reputation of being "on the square."

Thoroughness

There are three mental traits constantly called for in production work. The first one is *Observation.* Observation means really seeing what your eyes behold; it means seeing with your brains, getting into your mind whatever you see. It is the faculty that picks out essential points, gets the detail of a machine, or a plan, or an order, or a factory situation, as well as its general effect. Thoroughness would be impossible without observation.

Observation

Another mental trait is *Concentration.* Concentration is the power of focusing attention; of shutting out all that is foreign to the task or problem in hand, and of centering all attention, thought, and energy upon the one interest. The worker is called upon to concentrate upon his process. The manager is called upon to concentrate upon his problem of getting the production out. Concentration is based upon power of observation, and works toward thoroughness and decisiveness.

Concentration

The other mental trait is *Judgment.* The production man must be an accurate reasoner, he must be able to analyze closely, and to arrive at right decisions. Especially in the higher positions of foremanship and management he will find problems that will call for all his powers of analysis and reasoning. The steel industry in America is inseparably linked with the name of Captain Bill Jones, formerly superintendent of the Homestead Steel Works, and the trait that shone out in him with striking brilliancy was his unerring judgment. Let a situation arise in the mill, be it a question of management or of working methods, and Captain Bill could see through the problem and almost in a flash, it seemed, find the right way out. Such men seem to be endowed by nature with a genius for reasoning. Usually, however, the power is not a

Judgment

gift but the result of patient self-training and practise. Judgment is built upon observation and concentration, these three mental traits working together toward common ends.

Loyalty

What is your feeling toward your organization, your business? Do you take a pride in it, are you quick to defend its reputation when you hear it unjustly criticized, are you jealous of its interests? Have you "house patriotism"? These questions go to the heart of a very essential quality of the personality of the good production man. They may be summed up in one question: Are you loyal?

The manager of a large New England machine shop told this of one of the young men in his planning department whom he recently discharged: "There was nothing the matter with Blank's skill or his brains. He was one of the most brilliant men we ever took on. He had a technical school training, which few of our men have. In many ways he was exceptional. But he had one fatal defect: He was disloyal. He was continually 'knocking' the company, its methods, its product. So we let him go."

There was nothing else to do but let him go. No matter how capable a technician Blank might be, his disloyalty ruled him out of line for any executive work. Disloyalty in a foreman or other executive not only interferes with his own efficiency, but it affects the men under him. It kills their confidence in him, lowers their morale, hinders efficient teamwork. *Loyalty,* on the other hand, is like a chain of steel binding the individual to his organization, binding the leader to his men, and binding all into a strong team. Much can be overlooked in the loyal man, simply because he can be counted upon, both in everyday routine and in the rare emergency to stand by his house. He is honest, sincere, dependable.

Fairness

Someone asked a group of employees of the United States Steel Corporation: "How can you, in so vast an organization, get away from the cog-wheel attitude? Why is it that you seem to consider the corporation's interests your own?" The answer came back: "Because, in the steel mills the man who gives, gets. I feel bound to give the corporation a square deal because I know that it will give me a square deal."

Just as loyalty inspires loyalty, so *Fairness* inspires fairplay in others. In fact, these qualities, loyalty and fairness, are closely connected. It is the fair and square manager who wins the loyalty of his men. The slightest indication of injustice or intolerance is sufficient to destroy the good will which months of patient cooperation have built up. The man who is absolutely on the square—who will neither "do" his men nor permit the men to take any advantage of the company—is the man who wins confidence and respect, rather than the easy-going foreman who winks at small dishonesties.

Tact

But the good production man is more than merely just. He tempers his justice with sympathy and understanding. He has that intangible something we call *Tact.* He knows how to approach different kinds of men, realizing that what would influence and impress one man would be totally ineffective on another man of different temperament. He realizes the fitness of things. He doesn't make a "call down" any stronger than it need be to get the desired result. He doesn't "bawl out" a man when a little suggestion, or a quiet five minutes of frank reasoning in the privacy of the office, will do the trick. Tact does not imply insincerity. It is not a glossing over. It is simply adaptation. To get the other fellow's viewpoint and to adjust yourself to him so that he can accept your view with the least wrench from his own—that is what it means to be tactful.

Courtesy, fairness, judgment, insight into human nature—all these qualities enter into tact, along with sympathy and understanding.

Control

The tenth characteristic of the good production man is *Control.* Self-control comes first. Before a man can control others, he must be thorough master of himself. The manager who penalizes himself for infractions of the rules, who fines himself for tardiness, has a better grip upon the management of his men than the one who lets himself fall into loose business habits under the easy excuse that "the boss is entitled to some liberties." Not only the fact that he is fair and just, but the very act of self-discipline strengthens his sense of discipline and so increases his power to control others. Some men control through force or fear; in an emergency their control is apt to break down. Real control is leadership, and calls into play all positive winning qualities. It operates through tactful handling of men, through fairplay, through the appeal to loyalty. Confidence, respect, and esteem are its levers, rather than force or fear. And yet, real control is more than these qualities or the sum of them. It might be called a sense of authority and the ability to exercise it naturally.

The successful production man has also the *knack of* working with machinery—*Mechan-*

ical Ingenuity, which implies a love of machinery and a certain skill in adapting mechanical principles to everyday work. He can quickly "see through" a machine or a system of doing work. He is quick to apply mechanisms in ways which save time and labor. He may not be an inventor but he has ingenuity.

Mechanical Skill

Finally, the successful production man has thorough knowledge. His immediate need is technical knowledge, a knowledge of the principles and methods of industry, of the science of machine production, and of factory organization, system, and management. It may all be grouped under the heading, *Knowledge of Production Methods.* A great deal of this knowledge a man picks up in the ordinary course of factory experience, but it takes more than the casual hap-hazard training of experience to organize this knowledge and make it an orderly working part of his equipment. Many a factory man never seems to go beyond his immediate work; never even satisfies his curiosity as to the work of the next department. Of course he drags along in a rut; his grasp of the factory's technique is so narrow that he is doomed to routine.

Knowledge of Production Methods

The executive is a man whose knowledge is complete as to his field of business.

The sum total of these twelve qualities is personality—the type of personality best fitted for successful leadership in the production plant. If a man is content to be merely a good mechanic, or operator, or time-clerk, of course he may easily get along without some of these traits. But if he is ambitious for a foremanship, and the jobs higher up, all twelve qualities are absolutely essential. There is no one of them that can be overlooked without danger and serious risk.

This does not mean that he must start with a perfect development under each of the headings. Perhaps there is no man who could register 100 per cent efficient in each quality of personality. What is meant is this: To be a success in production work a man must have this combination of traits, each developed to a fair degree. Moreover, he must deliberately set himself to cultivate and strengthen his powers in each. The weak traits he can strengthen by self training. The strong traits he can reinforce and make more effective.

The necessary first step to any course of training is a self-analysis. Before you can develop yourself, you must know how you measure up—what are your strong points and where your weak spots. In the following chapter are a series of tests which will enable you to take your own measure.

VII

How Do You Measure Up

THIS is a chapter of tests. Its purpose is to find out where you stand on the twelve essential qualities of the successful production man. The tests have been carefully worked out and adapted to the needs of men and women who are actually engaged in production work, and provide a fair basis for self-examination.

At the same time, you must recognize that this is a *self*-examination, and its success is directly dependent upon your complete cooperation. You must follow instructions exactly. Be sure that you understand the meaning of each question before you attempt to answer. Many of the questions are in the nature of an appeal to your honesty of judgment and sense of fairness. You are asked to sit in judgment on yourself, to review your own record in certain particulars, and to give yourself a rating that conscience and reason dictate.

Self-Examinatio

Other tests are not left to your judgment, but can be definitely checked up by reference to the Key of Tests which follows Chapter

VIII. In the case of these tests, you must of course complete the test and put down your answer before you refer to the Key.

Be fair with yourself. Don't look ahead. Where time limitations are given, live up to them exactly. Where the one person who knows you better than anybody else—namely, Yourself—is called upon to be your judge, let his judgment be as even and as fair and as unbiased as human judgment can be. The purpose of the tests is to show you exactly where you stand in these necessary characteristics, and if you are over-strict or lenient in your judgment, the picture will not be a fair one.

Some of the tests, you will find, consist of working out puzzles and doing other mental stunts which may strike you at first as foolish. But bear in mind that these tests have been scientifically built up, that many of them have become standard through years of use, and that there is a good reason for everything you are called upon to do.

What You Need for the Tests

Before you take up the tests provide yourself with the following (1) a reasonably accurate watch, (2) a few sheets of blank paper, (3) two or three sharp lead pencils, (4) a ruler which measures as fine as sixteenths of an inch. Then begin the tests in order, finishing those under Physique, before you proceed to those under Energy, and so on. Try to complete all twelve tests and fill out your chart at one sitting. It can be done.

Of course, the results which you get and which you will record on your chart are for your personal guidance. The copy of the chart which you send to the Secretary of the Course will be held in strict confidence, and is intended only to assist him in making the training of the Course as personal and as closely adapted to your own needs as possible.

TEST OF PHYSIQUE

If none of the following descriptions seem to fit your case exactly, endeavor to give yourself a just rating on a scale of 0—20.

1. EXERCISE

If you daily take between one and two hours of exercise in the form of enjoyable out-door games and sports, credit yourself 10 per cent.

If you make it a point to get in two to four miles of walking out in the open air, credit yourself with 7 per cent.

If your have a regular set of exercises (with or without machines) which you perform daily either upon arising or retiring, credit yourself 5 per cent.

If you take very little exercise at infrequent intervals, credit yourself 2 per cent.

Rating for No. 1.................... ——%

2. EATING

If you eat slowly three sane, substantial, well-cooked meals, every day, credit yourself 10 per cent.

If you eat faster than you should and are not particular as to what combinations of food you eat, credit yourself 5 per cent.

If you bolt your food, and suffer some discomfort afterwards, with the certain knowledge that this discomfort will be aggravated as years go on, credit yourself 1 per cent.

Rating for No. 2.................... ——%

3. SLEEPING

If you are careful to get eight hours' sleep every night, in a well-ventilated room, lying in the correct bodily posture (right side) and with light downy coverings, credit yourself 10 per cent.

If you usually get eight hours sleep, but are not particular about posture, ventilation or covering, credit yourself 7 per cent.

If you usually get about six hours' sleep and think only to slam up a window before falling into bed, credit yourself 4 per cent.

Rating for No. 3.................... ——%

4. PERSONAL HABITS

If you use no tobacco, alcoholic beverage, narcotic, nor patent medicine of any kind, credit yourself 10 per cent.

If you smoke sparingly or moderately, drink alcoholic beverages sparingly, and take a patent medicine at infrequent intervals, credit yourself 5 per cent.

If tobacco, alcohol, narcotics or patent medicines have got a decided hold upon you, credit yourself 2 per cent.

Rating for No. 4.................... ——%

5. STRENGTH

If you have ever lifted an average-sized, full-grown person and carried him or her up a flight of stairs, or 100 ft. on a level; have ever hit the chopping block with the mallet and sounded the bell, have ever blown through the pneumatic tube, and sent the indicator up to its limit; have ever booted a football 60 yards unaided by the wind, credit yourself 20 per cent.

If you have ever lifted a 100-lb. bag of coal or flour and carried it 100 ft., performed any or all of the above mentioned strength tests creditably, credit yourself 15 per cent.

If you are just about medium strong and can do your share when helping to move a heavy table, desk, bookcase, or buffet, have done fairly well on the above-mentioned feats of strength, or similar ones, credit yourself 10 per cent.

If the most you ever lifted was a 40-lb. cake of ice or a 25-lb. scuttle full of coal, and never attempted any of the above mentioned feats of strength, credit yourself 5 per cent.

Rating for No. 5.................. ——%

6. ENDURANCE

If you have ever played 100 games of tennis in the course of an afternoon, played a complete football or basketball game against heavy odds, worked continuously 36 hours, walked 10 miles at a steady even gait, ran 2 miles or swam a mile, credit yourself 20 per cent.

If you have ever played tennis all the afternoon, lasted throughout a complete football or baseball game, worked continuously 24 hours, walked 6 miles at a stretch, ran a mile and swam a half mile, credit yourself 15 per cent.

If you play tennis with rests between sets, play a little at football and basketball, have worked continuously 16 hours, walked 4 miles at a stretch, and run and swim only a little, credit yourself 10 per cent.

If you have never tested your endurance at sport, walking, running, swimming, nor worked more than 10 hours at a stretch, credit yourself 5 per cent.

Rating on No. 6.................. ——

7. SIGHT

The chart for testing the sight is folded into the Unit opposite this page. It is highly important that this test be conducted in the daytime, and with a good light striking the chart. Select some place in the house where you can get a straight-away view for 20 feet. This can usually be done by opening the door between two adjoining rooms.

When these conditions are met, detach the chart and tack or pin it on the wall at a height about level with your eyes. Then stand off at a distance of 20 feet, close one eye, and note down on paper what you can read of each line. Each eye should be tested separately, and in each test you should write down in order the letters of each line as you read them. When this is completed, compare what you have written with the letters of the chart. If you have made no errors, credit yourself with normal vision, 10 per cent. If you have made errors, consult the following table for rating:

RIGHT EYE

Errors in					
6th	line,	none	in	preceding	8%
5th	"	"	"	"	6%
4th	"	"	"	"	5%
3rd	"	"	"	"	4%
2nd	"	"	"	"	3%
1st	"	"	"	"	2%

LEFT EYE

Errors in					
6th	line,	none	in	preceding	8%
5th	"	"	"	"	6%
4th	"	"	"	"	5%
3rd	"	"	"	"	4%
2nd	"	"	"	"	3%
1st	"	"	"	"	2%

For your rating, average the percentage for the two eyes. For example, if the right eye is 6 per cent and the left eye 5 per cent, the average rating is 6 + 5 ÷ by 2, or 5½ per cent.

Rating for No. 7.................. ——%

Rating for No. 7........................ ——%

8. HEARING

Are you aware that any defect exists in your hearing? If you hear perfectly well and no one has asked you whether or not you were slightly deaf, credit yourself with perfect hearing, 10 per cent.

If you sometimes have difficulty in hearing ordinary quiet conversation, and ask people if they will be good enough to repeat what they have said; make a practise of getting well toward the front at sermons, lectures, etc., credit yourself 7 per cent.

If you frequently have difficulty in hearing ordinary conversation and almost invariably have to have it repeated, have to have the front seat at sermons, lectures, etc., do not hear whistles when they blow or bells when they ring, credit yourself 5 per cent.

If you are very deaf, but can manage to hear what people say when they yell it into your ear, need an acousticon or other facilitating device when a man is lecturing in public, credit yourself 2 per cent.

Rating for No. 8.................. ——%

Total Rating for Physique............ ——%

Test of Energy

1. Do you prefer and play games and sports involving a tremendous amount of energy, such as football, basketball, tennis and swimming? If so credit yourself 20 per cent.

If you prefer and play those involving a more moderate expenditure of energy, such as baseball, golf or rowing, credit yourself 15 per cent.

If you prefer and play those involving only a slight exertion of physical energy, such as checkers, chess, dominoes and cards, credit yourself 10 per cent.

Rating for No. 1.................. ——%

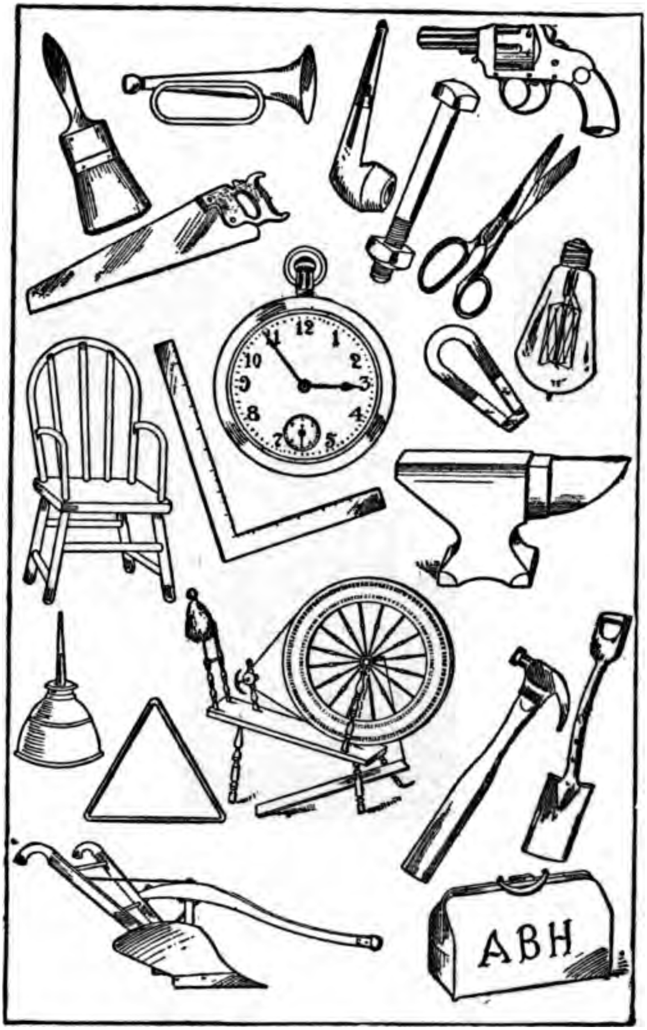


FIGURE FOR TEST OF OBSERVATION

2. At home, when you are more or less of a free agent, do you mow the lawn, shovel snow, work in the garden, study or engage in similar activities? If this is your regular practise, credit yourself 20 per cent.

If you do not qualify as a "hustler" around the house, but still do a reasonable amount of home work, credit yourself 10 per cent.

If your hours at home are spent in loafing, credit yourself 5 per cent.

Rating for No. 2.................. ——%

3. When you are at work do you go ahead at high speed, eager to get along to the next task? If so, credit yourself 20 per cent.

If your work is steady and consistent, but not marked by any exertion of energy, credit yourself 15 per cent or lower according to your judgment.

If you dally along until you are called down, if you are inclined to stretch a job along as far as it will go, credit yourself 5 per cent or lower according to your judgment.

Rating for No. 3.................. ——%

4. Are you punctual? Have you been on time every day without exception during the past month? If so, credit yourself 20 per cent.

If you are usually punctual, and the times you have been tardy would not exceed six, credit yourself 14 per cent.

For each additional time that you have been been tardy, subtract 1 from 14 per cent, crediting yourself with what remains.

Rating for No. 4.................. ——%

5. Have you ever devised a new system or method for handling work, and got it put into effect in the face of opposition and criticism? If so, credit yourself 20 per cent.

If you have put a new plan into effect and encountered little or no opposition, credit yourself 10 per cent.

If you have never by your own initiative or suggestion brought about any improvement in your department or business, credit yourself 5 per cent or less as your judgment dictates.

Rating for No. 5.................... ——%

Total rating for Energy............. ——%

TEST OF THOROUGHNESS

1. Are you precise and accurate in your work? As a test try yourself on the following. Work as rapidly as you can. You should not require more than 6 minutes.

> Take a plain sheet of paper measuring about 8 by 10 inches, an ordinary ruler which has subdivisions to sixteenths of an inch, and a sharp lead pencil. From any corner on the paper, which we will call A, measure 6 inches along one side of the paper to a point we will call B. From A measure 7 inches along the other side to a point we will call C. Draw a line to connect B and C. On this line from C to B measure 1 $^{15}/_{16}$ inches from C to a point which we will call D. On the line from B to A measure 1 $^{1}/_{16}$ inches from B to a point which we will call E. On the line from A to C measure 3 $^{5}/_{16}$ inches from A to a point which we will call F. Draw a line to connect E and F. On this line from F to E measure 2 $^{13}/_{16}$ inches from F to a point we will call G. Draw a line from D to G.

What is the measurement of the line D—G? After you have completed your drawing, turn to page 135 and check up your result.

Rating on No. 1.................... ——%

converts water into steam and water is cheap.

b. The prime reason for installing machinery in factories is to obtain a larger output at a lower unit-cost.

c. The invention of the gasolene engine made possible the rapid development of the automobile.

− *d.* Sawmills are located in forest regions because of the cheap fuel obtainable there.

− *e.* Increasing the speed of machinery decreases wages because it increases production.

− *f.* Because of the great popularity of Ingersoll watches and Kodaks, the manufacturers of those products are extensive advertisers.

+ *g.* Managers who have risen from the ranks usually make a success of handling men because they understand through experience the conditions under which workmen labor.

− *h.* The corporation is the usual form of organization of industrial enterprise because it enables the enterprise to have executive officers.

+ *i.* Many of the industries located at Buffalo went there because of the cheap power afforded by Niagara Falls and the excellent rail and water transportation facilities which meet there.

+ *j.* The telephone is a great boon to the factory because it saves time in transmitting messages from one department to another.

Turn to the Key on page 139 and grade yourself 3 per cent for each statement which you marked correctly.

Rating for No. 3..................

4. Have you been on the job every day without exception during the past year? If so, credit yourself 20 per cent.

If you have been absent from work not more than six times during the year, some for good reasons, some not, credit yourself 15 per cent.

If you have been absent an average of one day a month, credit yourself 5 per cent.

Rating for No. 4.................... ——%

5. Is it your unvarying practise to make yourself turn out work without a flaw, refusing all opportunities to "get by" with shoddy or imperfect work? If so, credit yourself 20 per cent.

If you have sometimes been compelled unwillingly to send out work which falls below standard, credit yourself 15 per cent.

If you have often allowed work to go out from your hands which was not wholly satisfactory to you but which you allowed to pass because of hurry or carelessness, credit yourself 5 per cent or less according to your judgment.

Rating for No. 5.................... ——%

Total rating for Thoroughness........ ——%

TEST OF OBSERVATION

Turn to page 96, and for one full minute study the figures illustrated there. Then turn back to this page and complete the test by answering the questions which follow.

1. In the following spaces write down the *names of the twenty* articles whose pictures you *have just observed:*

1. Anvil
2. Saw
3. Pipe
4. Triangle
5. Bag
6. Clock
7. Plow
8. Hammer
9. Bolt
10. Spinning wh.
11. Light Bulb
12. Magnet
13. ....
14. ....
15. ....
16. ....
17. ....
18. ....
19. ....
20. ....

2. What machine illustrated in an early chapter of this Unit appears in the group you have just observed?

Name the machine here............

3. What time of day is indicated by the watch which appears in the illustration?

Note the time here................

4. What initials appear on the traveling bag pictured in the illustration?

The initials.......................

5. Draw an elevation or outline of the front of the house in which you live, showing the number of stories, the number and arrangement of windows and doors, and all features which are visible when standing in front of it. You should proceed with this test now, without going out to take a look at the house, for the subject is one with which you are surely familiar. After you have completed your sketch, take it out and compare with the original.

Instructions for grading: Turn back to page 96 and check up your answers to questions 1, 2, 3, 4.

No. 1. If you were able to name correctly all twenty articles, credit yourself 40 per cent. Deduct 2 per cent for each article you failed to name.

No. 2. The name of the machine appears in the Key, page 136. If you noted it correctly, grade 10 per cent. If not, 0.

No. 3. If you noted the time correctly, grade 10 per cent. If not, 0.

No. 4. If you noted the initials correctly, grade 10 per cent. If not, 0.

No. 5. This is of course not a test of drawing ability, but of your power of observation. The sketch may be regarded correct if you have accurately noted on it all important features in their proper places. The highest rating on this question is 30 per cent. Grade lower according to your judgment.

Rating for No. 1.................... ——%

Rating for No. 2.................... ——%

Rating for No. 3.................... ——%

Rating for No. 4.................... ——%

Rating for No. 5.................... ——%

Total rating for Observation.......... ——%

TEST OF CONCENTRATION

1. Count the five-pointed stars in the figure on the opposite page. The count should be made without checking off or touching the stars as you count. *Time allowed, 2 minutes.*

How many?.....................

Turn to Key on page 136 and grade yourself acording to instructions noted there.

Rating for No. 1.................... ——%

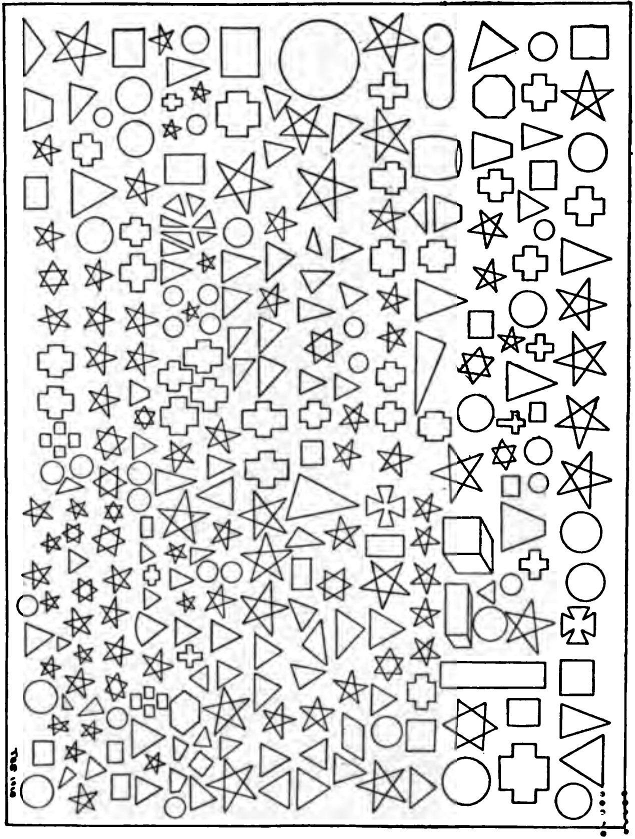
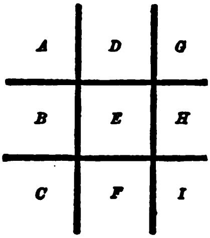
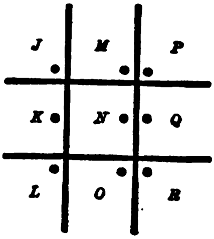
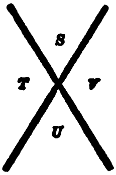


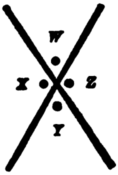
FIGURE FOR TEST OF CONCENTRATION

2. The following is a simple form of alphabetical code.









For example, A in the code would be written as ┘. N would be written as ⊡ and D as ⊔. Thus, to codify the word "AND" you write it ┘ ⊡ ⊔. The idea is simply to substitute the code character in each case for the letter of the alphabet which it represents.

Now for the test. Write in code the words Business Training Corporation. *Time allowed, 3 minutes.*

Write here.................................

....

Turn to Key, page 136, and grade yourself according to instructions noted there.

Rating for No. 2..................

TEST OF JUDGMENT

1. Out of six toothpicks or matches make 4 triangles, each side of each triangle to be the length of a toothpick. *Do not take more than fifteen minutes.*

For correct solution grade 20 per cent. Key on page 138.

Rating for No. 1.................... ——%

2. Suppose a clock starts running backward at 6 o'clock.

(a) In six hours will it tell the right or the wrong time.
Ans.................

(b) In 12½ hours will it tell the right or the wrong time.
Ans.................

Suppose another clock starts running backward at 6:30.

(c) In six and a half hours will it tell the right or the wrong time.
Ans.................

(d) In 12 hours will it tell the right or the wrong time.
Ans.................

Time allowed on the four questions, 2 minutes.

For each of these four questions answered correctly grade 5 per cent. Key on page 138.

Rating for No. 2.................... ——%

3. Following are ten statements, some of them true and some of them false. Mark a plus (+) in front of the true statements and a minus (—) in front of those you consider false reasoning. *Do not take more than three minutes.*

— *a.* The steam engine is the most gener*ally-used* source of power because it converts water into steam and water is cheap.

b. The prime reason for installing machinery in factories is to obtain a larger output at a lower unit-cost.

c. The invention of the gasolene engine made possible the rapid development of the automobile.

d. Sawmills are located in forest regions because of the cheap fuel obtainable there.

e. Increasing the speed of machinery decreases wages because it increases production.

f. Because of the great popularity of Ingersoll watches and Kodaks, the manufacturers of those products are extensive advertisers.

g. Managers who have risen from the ranks usually make a success of handling men because they understand through experience the conditions under which workmen labor.

h. The corporation is the usual form of organization of industrial enterprise because it enables the enterprise to have executive officers.

i. Many of the industries located at Buffalo went there because of the cheap power afforded by Niagara Falls and the excellent rail and water transportation facilities which meet there.

j. The telephone is a great boon to the factory because it saves time in transmitting messages from one department to another.

Turn to the Key on page 139 and grade yourself 3 per cent for each statement which you marked correctly.

Rating for No. 3.................. ———%

8. In an emergency are you willing to work overtime?

Rating for No. 8.................... ——%

9. Can you truthfully say that you have been loyal to every friend you ever had, or do you recall instances in which you would act differently if the thing were to be done over?

Rating for No. 9.................... ——%

10. How do you rate on loyalty to your country? Have you bought Liberty Bonds and War Saving Stamps, and have you really put extra "steam" into your work since the United States entered the war?

Rating for No. 10.................. ——%

Total rating for Loyalty.............. ——%

Test of Control

1. Have you ever tried to break yourself of a habit, like smoking, for example?

If you have tried and succeeded, grade 10 per cent.

If you have never tried to break a habit, but have a reasonable control over your personal habits, grade 5 per cent.

If you have tried and failed, grade 0.

Rating for No. 1.................... ——%

2. In an emergency, such as a fire or an accident, are your nerves ordinarily steady and under control, or do you "go to pieces"?

Grade 10 per cent or lower according to your judgment.

Rating for No. 2.................... ——%

3. Is your disposition even tempered, or do you anger quickly, lose your temper and flare up in a passion?

Grade 10 per cent or lower according to your judgment.

Rating for No. 3.................... ——%

4. When you are giving orders or directions, do you resort to profanity or loud talk to emphasize your authority?

If "No" grade 10 per cent; if "Yes" grade 0.

Rating for No. 4.................... ——%

5. Is it easy for you to decide matters that come up in the shop or at home? If so, credit 10 per cent. If you frequently let others make such decisions for you, credit 5 per cent or lower.

Rating for No. 5.................... ——%

6. Have you ever failed to receive an expected promotion because of your apparent weakness in control?

If "No" grade 10 per cent; if "Yes" grade 0.

Rating for No. 6.................... ——%

7. When you are in charge of men, either in your business or in outside organizations, do you easily maintain discipline or does it require a great deal of exertion on your part?

Grade 10 per cent or lower according to your judgment.

Rating for No. 7.................... ——%

8. If an accident occurs, do you generally take the lead in action? If so, credit 10 per cent. If occasionally, credit 5 per cent. If never, zero.

Rating for No. 8.................... ——%

9. Have you ever been elected to an office in your club, society, brotherhood or other organization? If so, did you make a complete success of your leadership?

If "Yes" grade 10 per cent; if "No" to either question, grade lower according to your judgment.

Rating for No. 9.................... ——%

10. Assume that you have been put in charge of a department whose efficiency has gone down because of poor discipline. Of the following five courses of possible action, which would you adopt as your first measure to build up the department?— (1) Discharge the offending ringleaders (assuming that you had that authority); (2) Make a speech to all the employees outlining your policies; (3) Post signs in the department announcing the new management; (4) Talk privately to the leaders among the employees in an effort to gain their good will and cooperation; (5) Allow matters to run along until some incident developed compelling immediate action.

Arrange these five in the order of their probable effectiveness.

Then, turn to page 137 for the key to No. 10.

Rating for No. 10.................. ——%

Total rating for Control............. ——%

TEST OF FAIRNESS

1. Have you ever shifted the blame for spoiled work or the failure of a job or some other mistake to another's shoulders, when it was really your own fault?

If "No" grade 15 per cent; if "Yes" grade 5 per cent or lower.

Rating for No. 1.................... ——%

2. When someone whom you dislike does a good piece of work, are you (a) willing to give him full credit and compliment him, or are you (b) apt to say nothing at all or to belittle what he has done?

If (a) grade 15 per cent; if (b) grade 5 per cent or lower.

Rating for No. 2.................. ——%

3. Have you ever been unfair in your use of authority? For example, have you ever threatened or mistreated a man under you, not because he deserved such treatment but because you disliked him and had a chance to "get even"? Have you ever from such motives injured another's chance for promotion, cast suspicion upon his character, ridiculed him, or otherwise hurt him?

If "No" grade 15 per cent; if "Yes" grade 0.

Rating for No. 3.................. ——%

4. In traveling on the train or trolley when the conductor has failed to collect your fare, have you notified him of his negligence and offered to pay?

If "Yes" grade 15 per cent; if "No" grade 5 per cent or lower.

Rating for No. 4.................. ——%

5. If the waitress in a restaurant should give you back too much change and you knew that she would have to make up the difference between the cash and the amount of the check, would you inform her of her mistake and correct it?

If "Yes" grade 15 per cent; if "No" grade 5 per cent or lower.

Rating for No. 5.................. ——%

6. When you have worked long on a certain task or problem and one of your associates makes a clever suggestion which greatly simplifies it, are you willing to mention this fact to your superior or do you say nothing, implying thereby that the idea is your own?

For strict honesty grade 15 per cent. Grade lower according to your judgment.

Rating for No. 6.................. ——%

7. If a person steals $100, is tried and found guilty of theft, and serves a year in prison, do you consider that there is any moral obligation to repay the money when he is again at liberty?

After you have decided upon your answer, turn to the key on page 137, and grade yourself 10 per cent if your answer agrees, 0 if it does not.

Rating for No. 7.................... ——%

Total rating for Fairness............ ——%

TEST OF TACT

1. Are you (a) easy to get along with, or are you (b) occasionally in a row with some of your associates, or are you (c) usually at outs with many of those with whom you have to deal?

If (a) grade 20 per cent; if (b) grade 12 cent; if (c) grade 5 per cent or lower.

Rating for No. 1.................... ——%

2. Are you (a) courteous and considerate in your dealings with those who rank below you, or are you (b) careless of your treatment of them, or are you (c) overbearing and domineering with those you regard as inferiors?

If (a) grade 20 per cent; if (b) grade 12 per cent; if (c) grade 5 per cent or lower.

Rating for No. 2.................... ——%

3. When you give instructions or orders or make a suggestion, does the other fellow show resentment, or does he really fall in with your ideas? In other words, can you exercise authority without giving offense or creating friction?

Grade 20 per cent or lower according to your judgment.

Rating for No. 3.................... ——%

4. Do you consider that you have a high *faculty of saying* and doing the right thing at the right time, or are you frequently chiding yourself for having "put your foot in it"?

Grade 20 per cent or lower according to your judgment.

Rating for No. 4.................... ——%

5. Are you uniformly cheerful, or do you get grouchy and glum on some days and cast a gloom on all about you?

Grade 20 per cent or lower according to your judgment.

Rating for No. 5.................... ——%

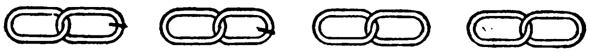
Total rating for Tact................ ——%

TEST OF INGENUITY

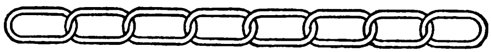
1. Have you ever made any mechanical inventions or originated any improvements upon existing tools, machines, or devices? Have you devised any labor-saving systems of handling your work, whether it be office work or work in a factory? Grade 25 per cent or lower, according to your record and fair judgment.

Rating for No. 1.................... ——%

2. Assume that you are called upon to make a chain out of the four pairs of links illustrated below:



To join these together so that they make an unbroken chain involves cutting some of the links, and then, after the connection has been made, welding the cut back so that in the end you have a chain of solid links as follows:

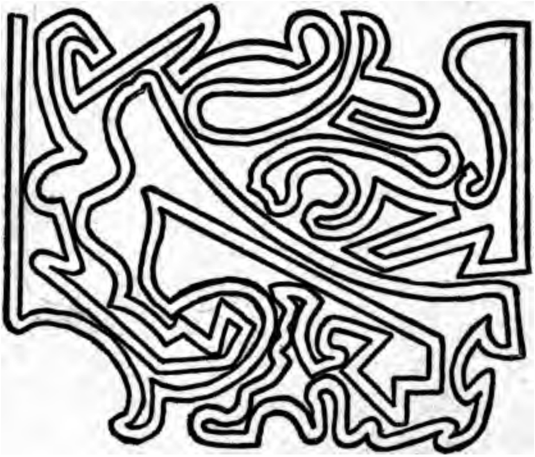


Each cut costs 10 cents. Each weld costs 10 cents. You are allowed a total of 40 cents to spend in making the chain. How would you do the job and keep within these expense limits? *Time allowed, 15 minutes.*

After you have completed your solution, turn to page 146 and compare results with the Key solution. If your solution is the right one, credit yourself 25 per cent. If you are unable to solve the problem, credit yourself 0.

Rating for No. 2.................... ——%

3. This is a test of your mechanical skill and accuracy of movement. With a sharp lead pencil trace a line between the two lines of the maze below. The test is to start in at the beginning of the maze at the upper left corner of the figure, and trace through to the other end without touching the line on either side. For perfect tracing credit yourself 25 per cent; deduct 2 per cent for each time your line touches a side. *Time allowed, 2 minutes.*



Rating for No. 3.................... ——%

4. From the ranks of the men in your trade or line of work who are equal to you in position pick out the one whom you consider has the highest rating for mechanical ingenuity. Then pick out the man whom you would rate as lowest in this trait. Let us assume that Thomas rates lowest and Green rates highest. Make up a list of five places, entering the two men as follows:

1. Green
2. ......
3. ......
4. ......
5. ......
6. Thomas

Now you have the two extremes of a scale. Fill in the four vacant spaces with the names of men whose mechanical ability you would rate in the order given. Let us assume that you select Smith as the man who deserves second place, that you rate Brown as third, and that Jones and Davis are given the fourth and fifth places. Call the top man's ingenuity 25, and grade them down as shown in the list below.

Green	25
Smith	20
Brown	15
Jones	10
Davis	5
Thomas	1

Compare your own mechanical ingenuity with what you know of these men in that trait, and rate yourself accordingly. Are you up to Green's standard? Then your grade should be 25. Is your ability in this trait as good as Smith's? If so, credit yourself 20. Are you about parallel with Davis, or do you really belong in Thomas's class? Rate yourself accordingly.

In performing this test it is important to remember that your own ability will be more clear to yourself than that of any of the other men is likely to be. If in doubt as to your ability to rate yourself fairly, get some friend in the trade who knows you well to apply this test to you.

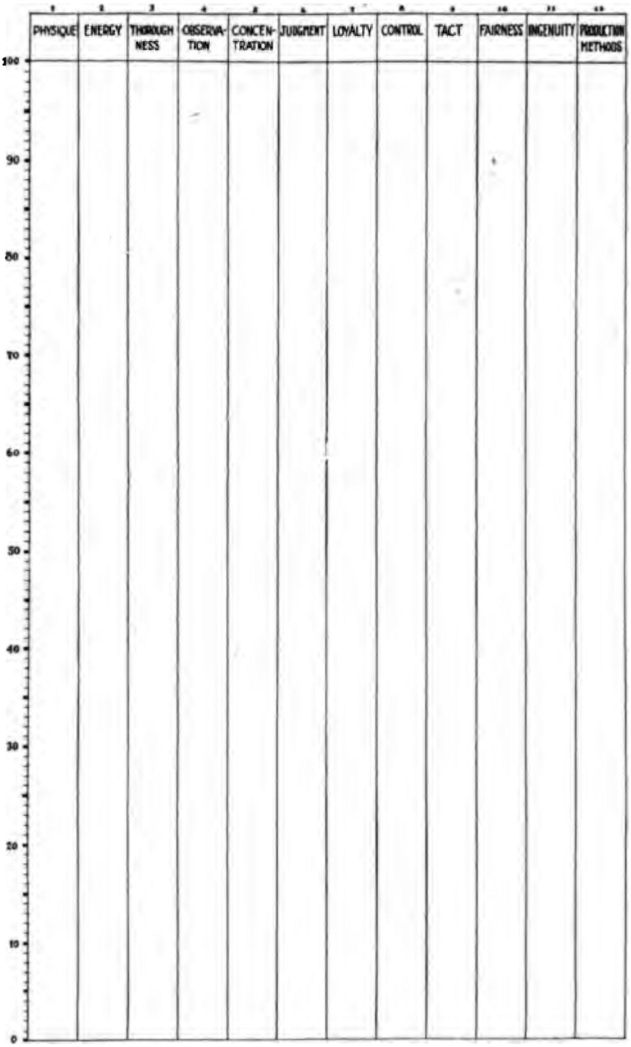
Rating for No. 4.................. ——%

Total rating for Mechanical Ingenuity ——%

TEST OF KNOWLEDGE OF PRODUCTION METHODS

Here are fifty terms connected with modern factory work. Check them as follows: Before each one that you understand thoroughly the meaning of, mark a plus (+); before each that you understand only vaguely, mark a question sign (?); before each that you know nothing of, mark a minus (—). Be sure that you know the factory meaning of the term before giving yourself a straight plus. Time allowed, 4 minutes.

+1. Organization chart
+2. Labor turnover
+3. Blueprint
+4. Piece rate
?5. A jig
+6. Prime cost
+7. Perpetual inventory
+8. Manager of personnel
+9. Shipper's invoice
?10. Motion study
+11. Depreciation
+12. Obsolescence
+13. Overhead expense
+14. Profit-sharing
+15. Auditing
+*16. The requisition*
17. Vertical filing
+18. Buyer's specifications
+19. Manufacturing to order
20. Tolerance dimensions
+21. Stores bin
+22. Cost-plus contracts
+23. Manufacturing to stock
+24. Plant site
+25. Sliding-scale wages
+26. Planning department
?27. Functional management
28. Shipping order
29. Instruction card


1
PHYSIQUE
2
ENERGY
3
THOROUGHNESS
4
OBSERVATION
5
CONCENTRATION
6
JUDGMENT
7
LOYALTY
8
CONTROL
9
TACT
10
FAIRNESS
11
INGENUITY
12
PRODUCTION METHODS
100
90
80
70
60
50
40
30
20
10
0

CHART

+ 30. Automatic machine
31. Semi-automatic machine
+ 32. Production order
+ 33. Salvage
+ 34. Lubrication
+ 35. Assembly manufacturing
+ 36. Patterns
+ 37. Gross profits
+ 38. Net profits
+ 39. Machine tool
+ 40. Progress chart
+ 41. Raw materials
+ 42. Supplies
? 43. Differential piece-rate system
+ 44. Insurance
+ 45. Power
+ 46. Machining
+ 47. Per-unit cost
+ 48. Plant layout
+ 49. Alphabetical file
+ 50. Cross section

After you have marked every one of the fifty items, turn to page 141 and check yourself up by the list of definitions given there. For every item that you correctly marked plus (+) credit yourself 2 per cent; for every item that you correctly marked with a question (?) credit 1 per cent; for every item that you were unable to define or recognize, credit 0.

Total rating for Knowledge of Production Methods................ ——%

Charting Yourself

Now that you have completed the tests and have assigned a rating to yourself on each of the twelve qualities or departments of the good production man, it is possible to summarize these results in the form of a chart. The blank chart on the opposite page is for this purpose. There are twelve vertical columns, corresponding to the headings of the twelve sets of tests which you have just completed. On the left, there is a graduated scale from 0 to 100, enabling you to indicate in each column the percentage rating which you attained on each test.

For example, suppose your rating in health is 75 per cent. Draw a line at 75 across the column headed Physique. Suppose your rating in Energy is 82; then draw a line across the Energy column at 82. Do the same for each of the other columns. After you have marked the height of your rating in each column, with ink or pencil black in the space underneath these lines, and you have a graphic chart of your traits and abilities.

VIII

Organizing Yourself for Advancement

"JENNINGS," said the superintendent of the Phœnix Machinery Company to his new aid, "there are certain things I have noticed in the month you've been with us. I'd like to talk them over frankly and find out if you feel about them the same as I do."

The young man, who had remained after hours to discuss with his chief the results of an investigation he had just completed, visibly stiffened. He was a rather high-strung young fellow, and there was just a hint of resentment in the "All right, sir," with which he responded to the announcement.

A Frank Conference

"Oh, there's going to be nothing disagreeable," explained the superintendent. "You remember when we took you on fresh from the school of technology, I told you it was your fine record as a student of mechanical engineering that won you the place here. We want fellows who are sound in the fundamentals. We've got more openings for that sort than we can find men to fill them. And I can truthfully say that we have not been disappointed in you. We expect you to become one of our most valuable men."

"Thank you, sir," said Jennings, now thoroughly at ease, and he settled back more comfortably in his chair.

"And of course," continued the superintendent, "we made some inquiry as to your character and habits, and satisfied ourselves on these points before we decided to take you into our organization. I don't hesitate to say that your record here has fully confirmed our judgment on that score. We know you are loyal, trustworthy, dependable.

"But," he hastened on, "we also realized at the beginning that your experience in actual contact with men was very slight. That handicap you frankly admitted. We accepted it, because we were confident that in the course of shop experience you would get the knack of working with others and winning their cooperation. Now you've had a month of it on this investigation. What's your own estimate? How did you make out?"

"I'm afraid I wasn't a whooping success," confessed Jennings. "I got the facts all right, but some of the men resented what they called my prying. Once they were downright discourteous in one of the shops, and I guess my *temp*er got the better of me."

"That reminds me of a story that Charlie Schwab tells," said the superintendent, smiling. "He had a foreman in one of his steel mills named Schmidt, and Schmidt was having rather a troublesome time with a gang of strikers. One day the foreman came into Schwab's office dripping with mud and water, and in answer to the amazed inquiry of his boss explained that some of the gang had thrown him into the creek. 'What did you do then, Schmidt?' asked Schwab. 'Oh, I shust laugh,' answered Schmidt.

Getting the Right Angle

"In lots of cases here in the office, out yonder in the yards, and in the factory, the best way to handle a situation is to 'shust laugh' like Schmidt. And in other cases, to laugh would be fatal. It's a matter of insight, of judgment, and of tact—of getting the right angle. To know when to laugh and when to be stern—that is one of the most difficult feats in factory management, Jennings.

"And one of the most necessary," added the superintendent. "I've had some rumors reach my office from the various shops where you spent days in your investigation. As I size it up, you went at the fellows the wrong way. I gave you the authority to study the shops, to get information from the men, and you went to them with that sense of authority uppermost in your mind. Of course you riled them. They saw you as an 'investigator,' somebody who was prying. You should have given them the impression that you were there as a 'cooperator.' Get across the idea of teamwork, of mutual interest, and most of our factory problems are solved—and not selfishly for the interest of the employer alone, but to the advantage of the men as well.

"Now don't think I regard your mistake as hopeless. Not at all. Perhaps it's a good thing to have a clear-cut example of how not to do it, so that we can see what to avoid in the future. What I am going to ask of you, Jennings, is this: Will you study this problem of adjustment to others, of cooperation and teamwork just as hard as you have studied problems of machine arrangement and plant organization. Look upon it as a problem in organization and management. You are strong in some features—in your technical knowledge and ability. Here you have discovered a feature in which you are weak. The task is to develop your weak faculties, to bring them up to the standard of your strong faculties. It's first of all a problem of organization, isn't it?"

"Yes, it is," said Jennings, enthusiastically. "I'm like a factory which has one of its de*partments* poorly equipped and under-manned. The job is a job of organizing myself for efficient work—of organizing myself as I would organize a production plant."

"You've got the idea exactly!" explained the superintendent. "Go to it, boy, and let's meet here in two weeks to note progress. We won't worry about the results of that investigation. It's this organization job you're tackling that's going to register big with me."

The Problem a Common One

There is scarcely a man in business who has not at some time or other been faced by some such problem as that which confronted young Jennings. It is seldom that you find a man whose development is all-round or complete. We are all of us specialists in some line. The feature that interests us—as mechanical work interested Jennings—has received the weight of our attention, and other features have been neglected. Our organization is one-sided. It needs overhauling, adjustment, and development.

The first step toward organization is investigation and analysis. Before you can remedy a situation, you must learn what is wrong. In Jennings' case it was the insight and frankness of the superintendent that picked out the weak spots and made him see them. In your case, this function has been performed by yourself through the medium of the series of tests provided in Chapter VII. You know how you measure up. You know the goal you are aiming at. The next step is to organize to reach this goal.

The factory that is aiming at 100 per cent production must be 100 per cent efficient in each of its departments. A 100 per cent manufacturing shop and a 75 per cent power plant will not get out the production. The combination of a 95 per cent purchasing department, a 62 per cent stores department, and a 100 per cent operating department, will not get out the production. The teamwork must be balanced. Poor equipment or inefficient work in one department will drag the rate of plant output down to its level.

And so it is in that production plant which we call the individual. If the loyalty department is weak, or if there is deficiency in the department of tact, the production of efficient service will be handicapped just to the degree of those weaknesses. If the department of physique is underdeveloped, high development of the department of energy will not make up for the deficiency. The good production man is an all-round man.

Deficiency in One Department Handicaps he Whole Plant

In the factory, a deficiency is remedied by *supplying the* needed element—it may be additional machinery, or a better grade of labor, or a better adjusted system. In any event it is a matter of organization—of putting together the right combination.

The principle is the same in the case of the individual, though it works out a little differently. The qualities of a good production man are developed through habit, that is to say through use. Physical exercise builds up the physique, and exercise of the mental and character traits builds up the mind and character. The genius with the marvelous memory and the amazing power of analysis and reasoning, is simply a man who through practise and repetition has schooled his mind to perceive and retain impressions and to think clearly. The man of tact is another patient learner in the school of habit—he has so practised courtesy and understanding and sympathy that they become second nature with him. Even the matter of getting knowledge can be reduced to terms of habit. Studying, reading, searching for facts—these do not ordinarily come as casual incidental activities, but are first of all the result of effort which in time becomes habitual and easy.

The starting point of habit is will power. The inveterate tobacco smoker did not come naturally by his habit. In the beginning he deliberately chose tobacco, he willed to

Habit is Built Through Will

smoke it, and he got into the way of smoking only by frequently willing to smoke. It is the same with every habit. If memory and concentration are weak departments in your make-up, you can develop them only by willing to remember, by willing to concentrate your attention. If you find yourself deficient in thoroughness, it is by putting your mind on this weakness and purposely setting out to be thorough, to be careful and watchful, to be persistent, that you build up the trait into a working habit.

John Stuart Mill emphasized this idea when he said: "A man's character is a completely fashioned will." That is to say, your combination of traits is the result of your will power. Leave yourself to be swayed by inclination, and you degenerate into a flabby characterless being. Assert your will, and you can make yourself whatever you wish to be.

Organizing yourself for advancement, thus, is a matter of exercise and habit acquired through the will. We learn through doing. Perfection is the fruit of self discipline. Skill comes through practise. And practise—doing the thing—builds a habit.

The athletic team depends upon habit to make its players skilful. It is through long continued practise that the baseball player becomes expert in pitching, in catching, in batting, in running bases. So with the factory team-member. Knowing what faculties are needed in his work, and knowing where he is weak, he is able to get skill and efficiency through habit, through practising the necessary faculties, through exercising the weak traits.

Teamwork is simply the proper organization of individual work. Team efficiency is dependent upon individual efficiency. Team organization rests upon individual organization.

Teamwork and the Individual

This is why the industrial manager is so constantly on the alert for the employee who is rightly balanced in physical, mental, and character qualities. This is why such employees win quick advancement and good pay. The very teamwork of the business depends upon them. They are the material out of which foremen, superintendents, and managers are made.

"The most valuable acquisition to business that an employer can obtain is the exceptional young man," says William Lodge, president of the Lodge & Shipley Machine Tool Company. "There is no bargain so fruitful."

Andrew Carnegie has said: "There is no one suffering so much for lack of the right man in the right place, nor so anxious to find him, as the owner of the industry. There is not a firm in Pittsburgh today which is not on the constant search for ability, and every one of them will tell you that there is no article in the market at all times so scarce."

In production work "the exceptional young man" is the one who possesses the twelve essential qualities each developed to a high degree. "The right man in the right place" is the man with the right attitude toward his business, who has a sense of teamwork, who has organized himself for efficient production.

The way to this development and organization has been pointed out. Succeeding units of the Course will illustrate in greater detail how these characteristics come into play in the everyday work of production. At the same time they will set forth comprehensively the principles of organization, system, management, and indicate the methods used. The starting point for all that follows is your attitude toward the business that employs you, your grasp of its purpose, and your will to qualify for a bigger job by making yourself a better individual producer.

Fundamentally, it is a matter of getting the right idea of teamwork. Get that, and you have a solid groundwork for training, for advancement, for success.

QUIZ QUESTIONS

I

1. What is meant by "the right attitude toward production work"?

2. How does the case of Farrell exemplify "the right attitude"? How is it shown in the story of Miller, the automobile-factory foreman?

3. Why is brain-work better paid than muscle-work?

4. How does "the cog-wheel attitude" differ from "the right attitude"?

5. What basic idea enters into "the right attitude"?

II

6. How would you describe the primitive age in terms of its industry?

7. What is meant by division of labor?

8. How did cooperation enter into the organization of industry under the Family System?

9. What advantage was gained through specialization?

10. Describe the origin of trading, as it is outlined in the text.

11. How did trading lead to the development of the Domestic System?

12. Name the six general types of business enterprises.

13. What were the craft guilds? How did they differ from the merchant guilds?

III

14. What was the Industrial Revolution? What element did it add to the teamwork of production?

15. What was Hargreaves' invention? Arkwright's? Crompton's? Cartwright's? Who invented the cotton

gin? The railway locomotive? How did James Watt contribute to the Industrial Revolution?

16. How did the coming of machinery affect the methods of production?

17. How did the coming of machinery affect the organization of production?

18. What is capital? How did the Factory System affect the rise of capitalism?

19. How does the sole proprietorship differ from the partnership form of business ownership?

20. What are the distinguishing characteristics of the corporate form, as contrasted with the two other forms of ownership?

21. What is the connection between the ideas of capitalism and of profit?

✓22. What is the distinctive feature of the Factory System?

✓23. What was the effect of machinery upon the factory workers? How did it raise the standard of living? How did machinery cheapen production?

IV

24. How does big-scale production lower the per-unit cost?

25. What is "overhead" expense?

✓26. Define the term standardization as it is used in modern industry.

✓27. How does standardization lead to specialization?

✓28. How is interchangeability of parts a factor in big-scale production?

29. In what ways has modern industry applied the principle of eliminating waste?

30. How does science serve industry?

31. What is meant by the statement that "Modern production calls for brain-workers"?

V

32. Name five distinct functions that enter into the *successful* operation of a business.

33. What four groups of factors are represented in the organization of the company charted in this chapter?

34. What group holds the ownership of the business?

35. What is the board of directors, and whom does it represent?

36. What is the function of the general manager (chief executive) of the business?

37. In the organization charted, what two executives are under the production manager? What three subdivisions are under the sales manager? What two departments are under the manager of finances? What three subdivisions are under the manager of accounts?

38. What is the function of the stockholders in the teamwork of the business? What is the function of the employees? ✓

39. What is the test of the productivity of work?

40. How is it true that every man and woman in the business is a salesman?

VI

41. Name the seven distinct types of the business man as enumerated in this chapter.

42. What two types are united in the makeup of the good production man?

43. Name the twelve essential traits of the good production man?

44. Why is physical fitness necessary?

45. If a man has good physique, how has he need of energy?

46. What is meant by thoroughness?

47. Name the three essential mental traits, and explain what they are.

48. Why is loyalty important in the makeup of the good production man?

49. Explain fairness. What is tact? What is meant by control?

50. What is ingenuity?

51. Why is it necessary to have business knowledge beyond the limits of one's own job or department?

VIII

52. How can your own problem of self-development be considered in terms of plant reorganization?

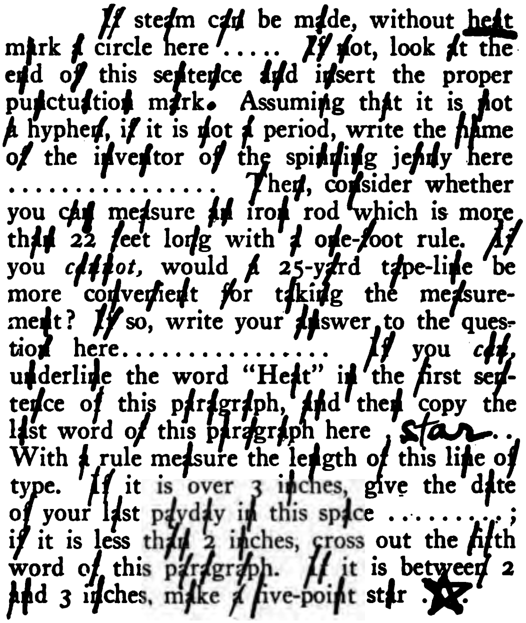
53. How does a weakness in one department handicap the entire production?

54. How can deficiencies in personal traits be remedied?

55. What is the starting point toward forming a habit?

56. How does the factory teamwork depend upon individual efficiency?

KEY TO TESTS



If steam can be made, without heat mark a circle here ..... If not, look at the end of this sentence and insert the proper punctuation mark. Assuming that it is not a hyphen, if it is not a period, write the name of the inventor of the spinning jenny here .... Then, consider whether you can measure an iron rod which is more than 22 feet long with a one-foot rule. If you *cannot,* would a 25-yard tape-line be more convenient for taking the measurement? If so, write your answer to the question here................ If you *can,* underline the word "Heat" in the first sentence of this paragraph, and then copy the last word of this paragraph here . star . . With a rule measure the length of this line of type. If it is over 3 inches, give the date of your last payday in this space ....; if it is less than 2 inches, cross out the fifth word of this paragraph. If it is between 2 and 3 inches, make a five-point star . .

HOW THE PARAGRAPH ON PAGE 99 SHOULD BE MARKED

THOROUGHNESS

QUESTION 1. The line D—G should measure exactly 4 inches. If your line measures this, credit yourself 20 per cent. If it is out by $^{1}/_{16}$ of an inch, credit yourself 16 per cent; if it varies by $^{2}/_{16}$, credit yourself 14 per cent; if by $^{3}/_{16}$, credit yourself 12 per cent; if by $^{4}/_{16}$, credit yourself 8 per cent. If it is out by more than $^{4}/_{16}$, credit yourself 0.

QUESTION 2. The paragraph should be marked as indicated in the illustration on the opposite page.

A total of 141 letters should be crossed out. If you have crossed them out correctly, credit yourself 16 per cent. Deduct 1 per cent from 16 for every five or fraction of five letters that you fail to mark.

If you complete the remainder of the test correctly, credit an additional 4 per cent. Deduct 1 per cent from 4 for every error made in this part of the test.

Thus, if you crossed out all letters you get 16 per cent, and if you complete the remainder of the test without error, you get 4 per cent, making a total of 20 per cent for perfection on this test. But suppose you fail to cross out six of the letters. Then you deduct 2 per cent from the 16—1 per cent for each five errors or fraction thereof. Suppose also you failed to make the star at the end of the paragraph. Then you would deduct 1 per cent from the 4 for this error. Your total rating on the test would be 14 + 3, or 17 per cent.

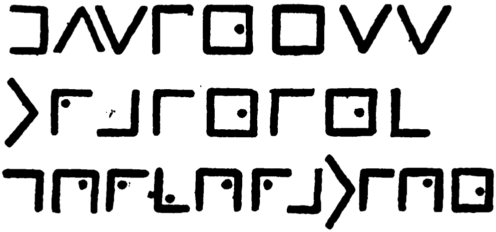
OBSERVATION

Question 2. Name of machine: The Spinning Wheel, which appears in the text on page 26.

CONCENTRATION

Question 1. The correct number of five-pointed stars in the figure is seventy-nine. If you counted that number within the time limit given, credit yourself 50 per cent. For each star in your count less or more than seventy-nine, deduct 2 per cent from 50.

Question 2. The words in code appear as follows:



If your code symbols are all correct, credit yourself 50 per cent. Deduct 3 per cent for each mistake made.

CONTROL

Question 10. The five methods, in the order of their value, are rated as follows:

First—Method No. 4, or Method No. 3, or both in combination.

Second—Method No. 2.

Third—Method No. 1.

Fourth—Method No. 5.

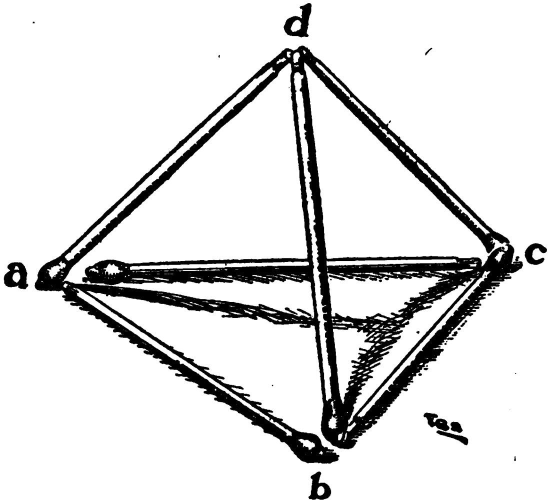
Should you place either No. 4 first and No. 3 second, or No. 3 first and No. 4 second, and arrange three in the order given above, rate yourself full credit of 10 for this question. Should you put No. 2 first, rate yourself 6. Should you put No. 1 first, rate yourself 4. Should you put No. 5 in first place, rate yourself 1 per cent.

FAIRNESS

Yes, there is that obligation, since his time in prison was in punishment for breaking the law and did not recompense the person injured by the theft. Strict honesty requires that the money be repaid.

JUDGMENT

QUESTION 1. On a table or other flat surface make a triangle out of three of the toothpicks or matches. Such a triangle would correspond to the bottom triangle, *a b c* in the figure illustrated below. Then take the other three toothpicks or matches, join them together at *d,* and then touch the other three ends at the angles *a, b* and *c* as illustrated in the figure. You then have (1) the base triangle *a b c,* (2) the triangle *a b d,* (3) the triangle *a c d,* and (4) the triangle *d b c.*



QUESTION 2. (*a*) If a clock starts running backward at 6 o'clock, in six hours it will show the correct time (12 o'clock). (*b*) In twelve and one-half hours it will show the wrong time (5:30 instead of 6:30). (*c*) If a clock starts running backward at 6:30, in six and one-half hours it will show the wrong time (12 o'clock instead of 1). In twelve hours it will tell the right time *(6:30).*

QUESTION 3. The following are the statements marked correctly, with the reason noted below in each case:

— *a.* The steam engine is the most generally-used source of power because it converts water into steam and water is cheap.

> (The reason given is a fallacy, for the cheapness of water has nothing to do with the popularity of the steam engine. It is the most generally-used source of power, because of its convenience and its low rate of operating cost. Water-power can be used only where there is a dam or a waterfall; the steam engine can be set up anywhere. Electric motors and gas engines, while they are just as movable, are usually more expensive to operate than a steam engine.)

+ *b.* The prime reason for installing machinery in factories is to obtain a larger output at a lower unit-cost.

> (This is true for the reasons given on page 41.)

+ *c.* The invention of the gasolene engine made possible the rapid development of the automobile.

> (This is true since the greatest development of the automobile has been in the field of gasolene-driven cars.)

— *d.* Sawmills are located in forest regions because of the cheap fuel obtainable there.

> (It is raw material, the logs to be sawed up, and not fuel, which brings sawmills to the woods.)

— *e.* Increasing the speed of machinery decreases wages because it increases production.

> (This is false reasoning, since machinery (as shown on page 35) has had the very opposite effect. By increasing the output per worker, it has increased the earning power of each worker.)

— *f.* Because of the great popularity of Ingersoll watches and Kodaks, the manufacturers of those products are extensive advertisers.

> (The popularity of the Ingersoll and the Kodak is the *result,* not the cause, of their advertising.)

+ *g*. Managers who have risen from the ranks usually make a success of handling men because they understand through experience the conditions under which workmen labor.

(The reason is obviously a true one.)

— *h*. The corporation is the usual form of organization of industrial enterprise because it enables the enterprise to have executive officers.

(An organization does not have to be a corporation to have executives; in fact both sole proprietorships and partnerships have them. The reasons why the corporation is the usual form for an industry are given on pages 32 and 33.)

+ *i*. Many of the industries located at Buffalo went there because of the cheap power afforded by Niagara Falls and the excellent rail and water transportation facilities which meet there.

(This is clearly true.)

+ *j*. The telephone is a great boon to the factory because it saves time in transmitting messages from one department to another.

(Another statement that is obviously correct.)

QUESTION 4. The following are the reasons marked correctly, with explanatory note under each.

Pennsylvania has become a more important manufacturing region than Virginia.

— *a*. Because it has larger cities.

(Larger cities are a result rather than a cause of the development.)

— *b*. Because it is wealthier.

(Another result, rather than a cause.)

— *c*. Because it was founded by a Quaker.

(No reason for specializing on manufacturing.)

+ *d*. Because it has rich deposits of iron, coal, and petroleum.

(Clearly this is a direct cause of industrial development—the possession of abundant raw materials.)

— *e*. Because it was there that the Declaration of Independence was signed.

(Has nothing to do with local industrial development.)

+ *f*. Because of its good facilities for transportation.

(This is clearly a logical reason.)

— *g*. Because of its larger population.

(A result rather than a cause.)

+ *h*. Because the early establishment of woolen and other textile mills in Pennsylvania early attracted a population which included many skilled workmen.

(The presence of skilled labor was certainly a factor in the development.)

— *i*. Because it is nearer to Chicago.

(Has no bearing on this subject.)

— *j*. Because of the greater fertility of its soil.

(This is not a reason for factory growth. In fact, Virginians would probably question the truth of the statement.)

KNOWLEDGE OF PRODUCTION METHODS

1. *Organization chart.*—A chart showing graphically the various departments or functions of a concern, and their relations with one another.

2. *Labor turnover.*—Labor turnover is the relation between the number of employees hired within a given period and the average number required to keep a plant adequately manned. Technically, labor turnover is computed on a percentage basis. Thus, if a factory has been compelled to hire 750 people during the year in order to keep up a force of 500, its labor turnover is 150 per cent.

3. *Blueprint.*—A photographic reproduction in blue and white, used principally for designs of machinery, tools, parts, for plans of buildings and layouts, and for organization charts.

4. *Piece-rate.*—When work is paid for by the piece, rather than by the day or some other period of time, the wage agreed upon is a piece-rate.

5. *Jig.*—A device for holding a piece of work and for guiding cutting tools, so that the operation will be the same on each piece. Used in machine shops principally, in the manufacture of duplicate parts.

6. *Prime Cost.*—The material cost plus the labor cost of producing an article. It may be called the production cost exclusive of overhead.

7. *Perpetual inventory.*—A system of keeping records of material and goods in stocks, which is widely used in modern store rooms and stock rooms. By showing deductions when articles are withdrawn, and additions when articles are added, it keeps continually up-to-date the record of articles on hand.

8. *Manager of personnel.*—The person in charge of hiring and firing, of welfare work, and personal relations within the factory.

9. *Shipper's invoice.*—When goods are shipped they are generally accompanied by an invoice, or list of the articles making up the shipment. The invoice is quite distinct from the bill or statement.

10. *Motion study.*—In the factory, a study of the movements made by a workman in performing an operation. The study is usually made with the aid of a stop watch, the purpose being to determine the time required, with a view to cutting out waste motions and waste time.

11. *Depreciation.*—The decline in value which an article sustains through wear and tear or through the lapse of time (obsolescence). In the factory the term is commonly applied to buildings and machinery.

12. *Obsolescence.*—The loss in value which an article sustains through becoming out of date or going into disuse, even though it may not have been injured or worn out; this is one of the two main sources of depreciation. New mechanical inventions and improvements frequently cause existing machinery to be scrapped long before it wears out.

13. *Overhead expense.*—That part of the expense of producing an article which is not attached directly to the article, like the cost of material and of labor, but which is nevertheless necessary to production. Overhead includes such items as light, heat, rent, taxes, salaries of foremen, managers, and other factory executives.

14. *Profit-sharing.*—The practise of granting to employees some share in the profits of a business. Various schemes of profit-sharing have been devised.

15. *Auditing.*—Checking up records or accounts in order to find out whether they are correct.

16. *The requisition.*—In the practise of modern stores departments, tool rooms, and stock rooms, articles are given out only when they are called for by a written order, or requisition, specifying the articles required and signed by a foreman or other person authorized to make requisitions.

17. *Vertical filing.*—Filing on end, rather than filing horizontally in a pile.

18. *Buyer's specifications.*—The purchasing department, in buying materials, frequently gives detailed specifications as to the weight, size, texture, grade, or other qualities required. These are buyer's specifications.

19. *Manufacturing to order.*—The production of goods to fill the order of a customer; the term is used in contrast with "manufacturing to stock."

20. *Tolerance dimensions.*—In mechanical work, the drawings or designs which guide the mechanic may contain notations indicating the tolerance, or departure from the standard dimensions, which may be permitted.

21. *Stores bin.*—A compartment or receptacle in the stores room or stock room in which articles or material of a certain kind is kept.

22. *Cost-plus contracts.*—Contracts by which a manufacturer agrees to turn out a certain production not at a flat price, but at cost plus an agreed extra. The extra may be a specified amount, or it may be a percentage of the cost. Much of the munitions manufacture for the government is done on a cost-plus basis.

23. *Manufacturing to stock.*—Manufacturing products and placing them in stock, in readiness for future orders. Contrasted with manufacturing to order (see No. 19).

24. *Plant site.*—The plot of ground occupied by the factory, or one upon which a factory is to be built.

25. *Sliding-scale wages.*—A piece-rate plan by which wages rise and fall with the selling price of the product. The result is to bring about a crude sort of profit-sharing and loss-sharing.

26. *Planning department.*—In modern factory organization, the department which makes and issues the production orders giving detailed instructions as to how each job is to be carried through. Frequently the planning department has charge of scheduling and of tracing progress of work.

27. *Functional management.*—A system of management in which the foremen are assigned to special functions, as contrasted with the system in which each foreman has control of all functions for a given department or group. The repair boss, the machine-speed boss, the gang-boss, for example, are functional foremen.

28. *Shipping order.*—A standardized form which authorizes the shipment of specified goods and gives directions as to the routing and delivery of the shipment.

29. *Instruction card.*—A card of directions instructing the workmen how a certain job is to be performed.

30. *Automatic machine.*—A machine, usually power-driven, which when started is wholly self-acting and self-regulating. Automatic screw machines and mechanical piano-players are examples.

31. *Semi-automatic machine.*—A machine which while self-acting in some of its operations, still requires an attendant. A turret lathe is an example.

32. *Production order.*—After a job has been analyzed, scheduled, the planning department or some official draws up a production, or manufacturing, order which specifies when the work is to begin and shows when the finished product is expected.

33. *Salvage.*—As used in the factory, salvage is what is saved from ruined or spoiled parts, condemned material, or other spoiled property.

34. *Lubrication.*—The oiling of mechanical bearings to reduce friction.

35. *Assembly manufacturing.*—A type of manufacturing which consists of assembling or putting together parts which have been manufactured in other plants.

36. *Patterns.*—Models which serve as examples or originals of the articles to be manufactured.

37. *Gross profit.*—The balance left after manufacturing, or prime, costs have been subtracted from sales income.

38. *Net profit.*—When all costs and expenses—including sales, administrative and overhead, as well as manufacturing costs—have been deducted from gross income, that which remains is the net profit.

39. *Machine tool.*—Machines for cutting, planing, drilling, turning wood and metal, etc., which have replaced hand tools.

40. *Progress chart.*—A graphic layout showing the progress of production in various interdependent departments during a certain period.

41. *Raw materials.*—The matter or stuff which enters into the manufacture of goods.

42. *Supplies.*—Materials used in production which do not actually enter into the manufactured product. For example, the fuel for the power house, and the lubricating oil for the machinery are supplies as distinguished from raw material. But in the gas works, coal is raw material for out of it the gas is actually made.

43. *Differential piece-rate system.*—A wage system by which the worker is given a standard task to perform, and paid a higher rate per piece if he does better than the standard.

44. *Insurance.*—A system by which, in consideration of a periodical payment or premium, a company or other agency assumes the risk of destruction by fire, death, or other loss.

45. *Power.*—As used in the factory, it means the motive power—steam, electricity, etc.

46. *Machining.*—Putting a product through a machine process.

47. *Per-unit cost.*—The total cost of production averaged over the total number of articles of a given kind produced, gives the per-unit cost.

48. *Plant lay-out.*—The chart or ground plan of a factory.

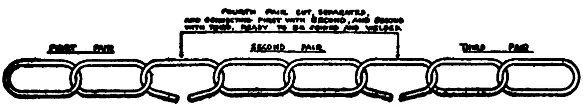
49. *Alphabetical file.*—A file indexed according to the letters of the alphabet.

50. *Cross section.*—A section of a body at right angles to its length.

(NOTE. Many of the subjects defined in the foregoing pages will be discussed in detail in later units of the Course.)

INGENUITY

QUESTION 2. There are four pairs of links. Take one of the pairs, cut both links and separate them. Then, with one link join two of the remaining three pairs; with the other link join these to the final pair. Then weld the two cut links, and you have a complete chain. Cutting the two links costs 10 cents each, or 20 cents; welding them together costs 10 cents each, or 20 cents—a total of 40 cents for the entire operation. The figure below illustrates the operation.


FOURTH PAIR CUT, SEPARATED, AND CONNECTING FIRST WITH SECOND, AND SECOND WITH THIRD, READY TO BE CLOSED AND WELDED
FIRST PAIR
SECOND PAIR
THIRD PAIR

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Cordially yours,

John Calder

ourse in Modern Production Methods.